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DISCUSSION PAPER NO. 220

Energy Price Increases, Economic Rents, and Industrial Structure in a Small Regional Economy

by K. H. Norrie and M. B. Percy

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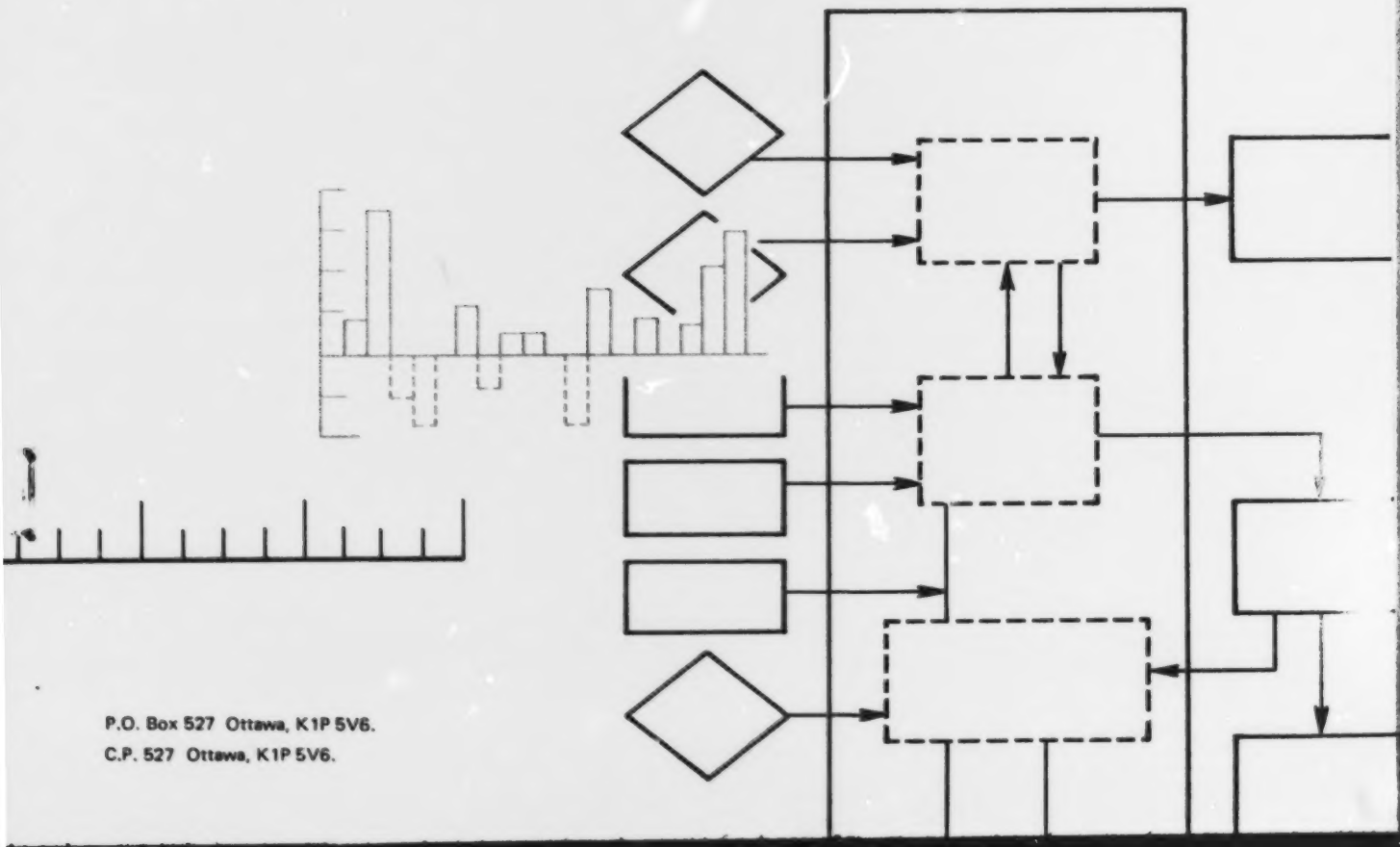

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RÉSUMÉ

La forte hausse relative du prix des produits énergétiques, depuis le début des années 70, a soulevé beaucoup d'intérêt pour la diversification régionale des activités économiques. Les recettes considérables et inespérées qu'ont touchées les provinces productrices, et le contrôle qu'elles ont réussi à exercer sur leur propre développement, ont assuré aux gouvernements de l'Ouest canadien (et particulièrement à l'Alberta) d'importants moyens de mettre en oeuvre des stratégies de développement optimal pour leur province. Certaines mesures -- comme le contingentement de la production de pétrole, l'accès préférentiel aux matières premières pour les entreprises de transformation locales, les subventions directes etc. -- sont des tentatives en vue de modifier la structure industrielle de l'Ouest. Les recettes dépensées pour subventionner les biens et services offerts par les gouvernements provinciaux peuvent contribuer à accroître les migrations, à faire baisser le coût de la main-d'oeuvre et, ainsi, à stimuler davantage l'industrialisation. (Il s'agit ici du phénomène dit des migrations influencées par la structure fiscale, dont parlent Flatters et ses collaborateurs, notamment Boadway).

Nous avons tenté de modéliser la relation entre les recettes provenant des ressources naturelles et la diversification économique régionale, à l'aide d'un modèle

d'équilibre général reproduisant une petite économie régionale ouverte et fondée sur l'exploitation des ressources naturelles. Cette recherche fait suite aux travaux effectués pour la préparation du Document n° 201 du Conseil économique, intitulé "Westward Shift and Interregional Adjustment : A Preliminary Assessment". L'économie stylisée que représente le modèle comprend six secteurs; l'industrie pétrolière, l'exploitation des autres ressources naturelles, le secteur manufacturier primaire, le secteur manufacturier secondaire, les services non commerciaux et le secteur public. La région est exportatrice nette des produits des trois premiers secteurs et importatrice nette dans le cas du quatrième. Les mouvements de capitaux et de travailleurs vers la région et vers l'extérieur suivent les variations des écarts de salaires réels. Le secteur public est conçu de façon à permettre toute une variété de modes de perception et de répartition des rentes, par exemple, des taux plus faibles de l'impôt sur le revenu des sociétés dans certains secteurs, et une diminution de l'impôt sur le revenu des particuliers. Le modèle sert aussi à vérifier la sensibilité de l'économie de la région aux économies d'agglomération. Les fonctions qui rendent compte des migrations permettent aux stimulants fiscaux d'influer sur le choix des lieux de résidence.

Nous utilisons ensuite le modèle pour simuler les répercussions de diverses stratégies de développement optimal

pour les provinces de l'Ouest et en tirer des conclusions pour l'élaboration des politiques. Dans quelle mesure y aurait-il diversification industrielle en l'absence de toute politique explicite de diversification économique; autrement dit, comment la région pourrait-elle normalement s'adapter à une hausse des termes de l'échange ? Quels effets pourraient avoir des politiques spécifiques comme celles qui sont énumérées ci-dessus ? Quelles catégories de personnes dans les provinces productrices, seraient les principaux bénéficiaires de la poussée du développement des ressources énergétiques et des politiques de diversification industrielle ? Quels seraient les perdants éventuels ? Quelqu'un pourrait-il expliquer comment ces considérations sur la répartition des revenus peuvent constituer un appui politique au développement optimal de ces provinces. Nous estimons que les efforts pour diversifier l'économie en misant sur la capacité financière de la région entraîneraient en général des pertes réelles de bien-être pour les résidants, bien que certaines personnes, comme les propriétaires fonciers urbains, s'en sortiraient nettement mieux. Cette conclusion dépend, toutefois, de la façon de spécifier les économies d'agglomération.

ABSTRACT

The large relative increase in the price of energy products since the early 1970's has created considerable interest in the phenomenon of regional economic diversification. The large windfall revenues of the producing provinces, together with provincial control over their development, have given the western governments (especially Alberta) substantial power to pursue province-building strategies. Policies such as pro-rationing, preferential access to raw materials for locally based processing activities, direct subsidies and the like are attempts to affect the industrial mix in the West. Revenues expended to subsidize the provision of provincial government goods and services can attract additional migration, lowering the price of labour and thus providing an additional stimulus to industrialization (this is the so-called fiscally-induced migration phenomenon discussed by Flatters et. al., and Flatters and Boadway).

We have attempted to model the relationship between natural resource revenues and regional economic diversification in the context of a general equilibrium model of a small, open, natural resource based regional economy. This model continues the work we began in our Economic Council Discussion Paper #201 "Westward Shift and Interregional Adjustment: A Preliminary Assessment". Our stylized economy has six sectors - oil, other primary resources, primary manufacturing, secondary manufacturing, non-tradable services and government. The region is a net exporter

of the first three types of goods and a net importer of the fourth. Capital and labour flow into or out of the region in response to real earnings differentials. The government sector is constructed so as to allow for a variety of rent collection and disposition schemes such as lower corporate income taxes on specific sectors and lower personal income taxes. The model is also used to test the sensitivity of the regional economy to the existence of agglomeration economics. The migration functions permit fiscal incentives to affect place-of-residence decisions.

We then use this model to stimulate the implications of various province-building strategies, and to draw policy implications from this. How much industrial diversification would occur in the absence of any explicit economic diversification policies; that is, what is the normal regional adjustment to a terms-of-trade increase? What impacts might specific policies such as those listed above have? What groups within the producing provinces will be the main beneficiaries of the resource boom and industrial diversification policies? Will there be any identifiable losers? Might one be able to explain the political support for province-building on the basis of these income distributional considerations? We find that the efforts to diversify the economy using the fiscal capacity of the region will in general impose real welfare losses on the residents of the province although certain groups such as urban land owners are clearly better off. This conclusion is sensitive however, to the specification of agglomeration economies.

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I Introduction

The relative increase in petroleum prices since 1973 is without doubt the single most important economic event of the last decade in Canada, judging by the number of significant political and economic problems it spawned. Some of these Canada faced along with the other industrial nations. Thus we were forced to reevaluate the adequacy of existing reserves, and to consider ways of reducing consumption and increasing production of both conventional and new energy sources.[1] We also shared in the stagflation brought on by the oil price increase, although a year or two after other less well-endowed nations, as we faced the difficult task of transferring real resources to the oil-producing nations.[2] Politically, the Canadian government was as perplexed as any other as to what the shift of political power to the oil-rich Middle East might eventually imply for world peace.

The energy developments created some uniquely Canadian problems as well though. For example, the large foreign ownership of the petroleum sector meant that in the absence of new policies much of the economic rent from oil and gas production would automatically accrue to foreigners.[3] Further, the equalization scheme broke down under the weight of the massive resource

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[1] See for example Government of Canada (1973,1980).
[2] See Purvis and Flatters (1981) for a discussion of these issues.
[3] See Scarfe and Wilkinson (1980) and Wilson (1980).

revenues flowing to the western provinces, forcing Ottawa to invoke a series of arbitrary and ad hoc alterations to the formula[4] before finally threatening to alter it unilaterally upon its expiration.[5] The overlapping jurisdictional responsibilities with respect to energy meant that it soon became a major constitutional and political issue. Federal energy policies were continuously opposed by the provinces on the grounds that they usurped provincial rights, while Ottawa just as stubbornly insisted that it had the right and even the duty to intervene as it did. Prime Minister Trudeau's constitutional reform measures almost certainly received a much more skeptical reception than might otherwise have been the case because of the legacy of these suspicions. At the political level the National Energy Program of October, 1980 stimulated a spectacular burst of support for the heretofore obscure western separatist groups.[6]

The final domestic implication, and the one that is the primary focus of this present paper, is that the energy price increase has presented a severe challenge to the country's regional structure. While regional economic development has been a topic of concern for analysts and policy-makers since 1867, the energy crisis posed some entirely new and unique problems for the Canadian federation. The novel aspects of the challenge arise

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[4] The best known reference to this is the work of Courchene (1976,1980).
[5] See the discussion in MacEachen (1981) and Parliamentary Task Force on Federal-Provincial Fiscal Arrangments (1981).
[6] See Pratt and Stevenson (1981) for an analysis of western separatism.

from the facts that the energy resources are concentrated in the three westernmost provinces away from the main Canadian centres of population and industry, that the East is a major consumer of western petroleum products, that the BNA Act assigns control over land and resources to the provinces rather than the central government, and that historical accident has meant that much of these energy reserves have not been alienated to the private sector.

The geographical factor means that the inevitable intersectoral reallocation of resources occasioned by the relative price change has a substantial spatial or interregional element to it. Capital and labour attracted to the energy sector and away from others find it necessary to relocate across great distances and across jurisdictions. Besides complicating the actual adjustment process, this movement of factors from one jurisdiction to another adds a political element to the analysis. Provincial governments often view any outmigration of capital and labour, however natural in an economic efficiency sense it might be, as an unmitigated disaster, while recipient jurisdictions typically welcome it unconditionally. If the shift also goes against the developmental bias of the central government, as it is often alleged any reallocation of economic activity out of Central Canada would[7], it is certain to become a policy issue.

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[7] The most explicit summary of this view can be found in Smiley (1976).

The fact that the East consumes western petroleum products means that a portion of the real resources they must transfer as a result of the terms of trade shift accrues to other Canadians. Objectively seen this should not be a concern since the alternative is to make the same transfer to foreign suppliers. It can be shown, in fact, that the transfer process is eased considerably by the various institutions of the federation.[8] But as Douglas Hartle (1980) has observed, there is an unavoidable element of jealousy in any internal transfer of this type,

> ... there is nothing quite like a massive windfall gain to cause dissension and bitterness in the family, however closely knit. The bitterness, indeed hate, engendered among family members when the estate of a wealthy relative is being divided knows no bounds. Perhaps for the very reason that none, if any, of the beneficiaries in waiting 'earned' the assets, at least in the usual sense the claims and counterclaims must be based on entirely subjective criteria: criteria tht are usually highly charged emotionally and, hardly surprisingly, seldom fail to imply an allocation favourable to those who advocate them. The controversy surrounding the Canadian energy situation has all of these attributes and more.

Thus legitimately or not, the fact of the transfer becomes a policy issue.[9]

Provincial control over resources adds another element to the picture in the form of province-building strategies being pursued by the producing regions. It was inevitable that these governments should view the energy price increase as a one-time

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[8] See Norrie and Percy (1981b) for a discussion of the transfer process within Canadian Confederation.

[9] See Mintz and Simeon (1982) for an analysis of what they term "conflict of claim" in a federal system.

opportunity to expand and diversify their economies.'[10] Control over energy resources has been interpreted as authorization to implement export controls (e.g. natural gas), pro-rationing, preferential access to raw materials for locally based processing industries, regional content input regulations and local hiring policies. Since measures of this sort will have considerable impact on both the regional and the national economies, they need to be analyzed specifically.

The final and perhaps the most important factor centers on the imbalance in government revenues from resource production. The large relative increase in the price of energy products, coupled with the fact that the western provinces retained considerable portions of these deposits, has given them (especially Alberta) huge windfall revenues. Fiscal imbalances of this type potentially can cause significant resource misallocations within the country as a whole. Inefficiencies can arise if the provincial governments use the revenues to subsidize their province-building efforts outlined above. Offering relatively lower rates of corporate income tax would be one example of this, while direct grants or subsidized feedstock prices would be others. But problems may occur even if the entire benefits are disbursed through some combination of lower taxes

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[10] There are numerous references to western province-building aspirations. See, for example, Pratt (1977), Richards and Pratt (1978), Norrie (1978). For a more general discussion of province-building see Evenson and Simeon (1979) or Stevenson (1979).

and expanded government services. Too many people may be drawn to the western provinces because of their perceived fiscal capacities, at the cost of a misallocation of factors across regions more generally. Again, the need for a careful policy analysis is clear.

Two themes emerge from these considerations. First, what is the impact of energy price increases on the economic development of the western region per se? For example, is it true to say that the energy boom is (or will be) transforming the western region into a more industrialized and diversified economy? Can this happen independently of explicit province-building policies, or will the western provinces need to intervene to promote it? If the latter, are there any significant efficiency costs to following such a course? What impact would specific policies such as corporate tax reductions have? What groups within the producing provinces will be the main beneficiaries of the resource boom? Will there be any identifiable losers? How will the distribution of benefits be altered as a consequence of adopting certain policy measures? Do these distributional consequences provide insight into the political debate within the West over industrial diversification?

The second object is to analyze the nature of the interregional adjustment to the higher energy prices. Exactly how is it accomplished, in terms of goods and factor flows? Is there any reason to suspect that the process is flawed in the sense

that some economic distortions are being introduced or tolerated? If so, are there any policy remedies? What are the income distributional consequences of the energy boom in the consuming provinces? How are these affected by the various western and/or federal policy initiatives?

We proceed as follows. Section II of the present paper reviews the existing literature on regional growth and interregional economic adjustment. Section III then presents and discusses a general equilibrium model of a resource rich regional economy, constructed in such a manner as to allow for an activist regional government. Section IV provides some simulation results, based on western Canadian data sources, to illustrate the impact on the region of an energy price increase under different economic circumstances and policy options. A final section provides some concluding comments. The second theme of interregional adjustment is taken up in a subsequent paper ("Natural Resource Rents and Interregional Adjustment"). Here a two-region general equilibrium model, designed to represent a resource-rich West and an industrial East, is developed, and a similar series of simulation exercises carried out.

II Literature Review

The intention of this section is to provide a review of those portions of the literature which have influenced the specification of the models to be presented below. It will be remembered that there are two principal issues to be discussed. First, what is the process of adjustment to an increase in energy prices in a small, resource-rich regional economy, and what role can and do government policies play? Second, what is the nature of the interregional adjustment to this same energy perturbation, and what is the scope for government policy? We first review three main strands of literature relevant to the first objective, before surveying multi-region models in the final sub-section.

a) Regional Growth Models

Regional growth models have as their objective to explain changes in regional output and per capita income over time. The familiar starting point for a review of such models is the strict neo-classical version, and there is no better example of these than the one developed and tested by D.M. Smith (1975). It differs from the familiar growth models only insofar as it attempts explicitly to incorporate the unique institutional features of a regional as opposed to a national economy. Potential output, which because of the full employment assumption is identical to actual regional output, is a function of the

available stocks of capital and labour and the level of technical progress. The capital stock grows over time at a rate permitted by the supply of local savings less depreciation, plus net capital flows to the region which are postulated to depend on real return differentials. The labour force grows by a combination of exogenous natural increase and interregional migration that responds to real wage differentials. Technology increases at a constant rate. The model is solved for the equilibrium growth rate of per capita output, and convergence of all regional economies to the same level is predicted.

This neoclassical model is purely supply determined in the sense that actual regional output is predicted to be whatever the available supplies of inputs will permit. Growth rates will vary over time or across regions only as the availability of capital, labour and technology does. This emphasis on supply constraints is important in modelling a booming economy such as western Canada after 1973, as is the formal incorporation of the fact that these are more elastic in the case of regional economies. Interregional migration functions must clearly be an important part of the modelling exercise. The shortcomings of the simple neo-classical model for present purposes follow from the fact that we are interested in tracing the impacts of one specific sector - energy - on the rest of the regional economy. Thus the emphasis on aggregate as opposed to sectoral or industrial output is inappropriate, as is the total neglect of demand

considerations.

Export base theories'' go to the opposite extreme in ignoring supply constraints entirely, and focussing only on the demand side. In essence, these are a special case of simple Keynesian multiplier models. Aggregate demand is identified to be the sum of consumption, investment, government and net export expenditures. An exogenous change in any of these has a multiple effect on aggregate demand, with the size of the multiplier depending on the various propensities to spend on domestic as opposed to "foreign" goods and services.'[12] If the primary source of exogenous fluctuations in aggregate demand is the export sector, as it is quite likely to be in a small, highly specialized regional economy, it is natural to associate fluctuations in growth rates over time or among regions with fluctuations in export sales; hence the appellation export base.

As in all multiplier models of this sort, supply is assumed to adjust passively to meet the output required. This is tenable only if there are large supplies of unemployed factors in the region already, or if the supply of these from other areas is perfectly elastic. Since neither of these is likely to be the case for western Canada, some supply side considerations will

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'' See Stabler (1968) for an overview of export base models. Interestingly, these are examples of models initially developed for regional economies that have been applied to national growth experience.

'[12] Export base theory typically refers to these as linkage effects, generally termed backward, forward and final demand.

need to be incorporated. The export base models are useful though in that they focus on what is certainly an important dynamic in regional growth experience. Indeed, given that we wish to investigate the general impact of changes in energy prices and outputs, and given that these products are large net exports for the West, such attention is crucial.

There have been numerous attempts to synthesize supply and demand factors in regional growth models. Anderson (1976) provides one example for an interactive model, where increases in aggregate demand put upward pressure on factor prices, leading to inmigration which in turn feeds back onto aggregate demand. Ghali et.al. (1981) develop a recursive system whereby factor supplies determine output, which together with population then establish domestic demand. Factor flows are linked to earnings in the region and thus to aggregate demand and supply conditions. Gillen and Guiccone (1981) also attempt a synthesis of neoclassical and export base models, although theirs is primarily intended for use with urban areas. In all of these, the main development of use in what follows is the recognition that population inflows add simultaneously to aggregate supply and demand.

A special type of integrative model comes under the general heading of growth pole or cumulative causation theories. The inspiration for this work lies in the writings of Myrdal (1957) and Kaldor (1970). Demand considerations figure in that exports

often appear as the main initial stimulus to economic growth.'[13] Considerably more attention is paid to the supply side though. There is usually an aggregate production function linking regional output to stocks of factor inputs. Factors migrate to and from the region as well, although generally in a more complex form than simply with respect to factor price differentials. The main feature of these models however is the explicit development that is given to an alleged link between the level (or the rate of change) of aggregate output and regional productivity. Large regions, or rapidly growing ones, are judged to be more productive than small or depressed ones.'[14] This is ascribed to one or more of agglomeration economies, scale economies, selective migration, lower internal transportation and communication costs, and the like. The result is that growth becomes self-reinforcing. Exports increase and output expands, increasing the rate of technical advance and thereby lowering costs, resulting in even greater export success, and so forth. The reverse sequence is applied to declining regions.

Richardson's (1973) attempt at a grand synthesis of regional growth is an especially interesting example of a hybrid neoclassical-regional science model. He has an aggregate production function to serve as a supply constraint. Factor migration equations are neoclassical insofar as return

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[13] This is done explicitly in the case of Dixon and Thirwall's (1975) version of Kaldor's model.

[14] This is often represented, as in Dixon and Thirwall (1975), as Verdoorn's Law.

differentials are entered as arguments, but there is an attempt to include regional agglomeration economies and locational preferences as well. Technical progress is not left exogenous, but rather is specified as a function of agglomeration economies, the rate of investment, the importance of leading urban areas, and the degree to which national technical developments might be diffused to the region (the connectivity factor).

These models are useful in that they draw attention to the complex mix of technological factors that unquestionably underlie the regional growth process. It is almost certainly true that growth is cumulative in the manner that these models would have it; there is just no other way to explain the great divergence in growth experiences across regions and over time. The problem is that we still know so very little about exactly what this agglomeration process is, and even less about how to model and quantify it. It is the ultimate "black box", in much the same way that technical progress factors have always been. In a modelling sense it can be incorporated so as to drive the entire growth process. Without it growth is stable, whereas with it specified in some arbitrary manner growth becomes cumulative. If the coefficient is made large enough growth can be made explosive. Thus while we experiment with factors of this nature in what follows, we wish to indicate at the outset that we do so with great misgivings.

A basic problem with the above models is that they do not formally distinguish the different production structures.[15] Output is usually expressed as regional GNP, even in regional science models such as Richardson's where so much attention is paid to other details. This is a serious shortcoming for present purposes since our main interest lies in analyzing the implications of developments in the energy sector on such things as industrialization and diversification, housing prices, government taxation revenues and expenditures and the like. To do this properly, some type of multi-sector model is needed.

b) Static General Equilibrium Models

Multi-sectoral, general equilibrium models at the level of a hypothetical national economy are numerous by now. Their earliest, and still most prominent, use was in international trade in connection with questions of factor price equalization, the impact of tariffs on the distribution of income,[16] and the effect of an exogenous increase in the supply of one or more factors (the Rybczynski theorem). The other prominent use has been in the field of public finance,[17] where questions of tax incidence have been important. They have also been used to

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[15] The exception is export base models that have explicit links to the input-output structure of the economy in order to pinpoint the specific multiplier effects.

[16] The list of references here is huge. Prominent recent examples are Pope (1972), James (1978), Boadway and Treddenick (1978), and Harris (1982).

[17] Again the references are extensive. The work of Shoven and Walley (1972) is perhaps the best known.

examine the effects of pre-Civil War land policy (Passell and Schmundt, 1971), war on the British economy (Heuckel, 1971), the contribution of the wheat boom to Canadian per capita income (Chambers and Gordon, 1966), the implications of the 1911 Canada-US Reciprocity Agreement (Percy, Norrie, Johnston, 1982), immigration (Epstein, 1974), export taxes (Burgess, 1976), and urban transportation changes (Arnott and MacKinnon, 1977) to cite but a few.

The exact formulation of these models varies, but the basic approach is well illustrated in the now classic papers by Jones (1965, 1971).[1] A number of distinct sectors (usually, but not always, two) are identified, with separate production relationships. There are fixed stocks of primary inputs, at least some of which are free to reallocate among sectors until returns are equalized. The separate sets of equilibrium conditions are specified; unit cost in each sector equals output price, factor demands equals factor supplies, and commodity markets clear. In some of the more complex extensions there are additional restrictions such as those on government expenditure versus taxation receipts or foreign exchange markets that also have to be met. The solution takes one of two forms. In one case the entire set of equilibrium conditions is totally differentiated, with the vector of endogenous variables then solved for in terms of exogenous variables and parameters. The alternative is to

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[1] Many of the subsequent papers have adapted his specifications explicitly in fact, even to the notation.

utilize one of the computational algorithms available to calculate the market clearing vector of endogenous variables. In either case, if the system is shocked by altering the values of one or more exogenous variables (e.g. policy changes) one can solve for the induced effect on the remainder of the system.

Models of this type are in one sense ideally suited for present purposes since the object is to determine the various effects of an exogenous increase in petroleum prices. Energy figures in the economy as an input to other sectors, as a competitor to them in the capital and labour markets, as a source of government revenue, and as an export item for the West and an import one for the East. All of these effects must be considered simultaneously if they are to be assessed properly, which requires the use of a general equilibrium model. By designing the sectoral specification carefully, the model can be made to correspond to the policy issues that are of interest. Thus if a resource processing sector is identified separately the impacts of subsidizing feedstocks can be ascertained, or if a government sector is identified various taxation and expenditure options can be simulated.

The drawbacks to general equilibrium models are several, and we shall have occasion to mention these more specifically below. The two main problems are the competitive assumptions that are required, and the fact that they can only compare alternative equilibrium states. The competition assumptions are used in the

equation of unit costs to prices, and in the factor demand terms. The inability to discuss disequilibrium states means that many of the interesting phenomena that arise as the economy moves from one equilibrium to another must be ignored. A final point is that these models quickly become analytically very complex, meaning that one runs the risk of them becoming "black boxes" where any result can be justified ex poste but not ex ante.

General equilibrium models have been used for regional questions in two separate ways. The first has been to specify the model as above, but to identify specific sectors with certain regions. Thus in the Chambers-Gordon model mentioned above "wheat" is taken to be the Prairies after 1900 while "gadgets" is the East. The "Dutch disease" literature also falls into this category insofar as it is used for regional purposes. Generally these models'' are interested in analyzing the mechanisms whereby a boom in one sector such as mineral or energy exports can lead to de-industrialization. These can take several forms. An expansion of primary sector output creates excess demand for mobile factors such as labour, raising wages and squeezing profit margins for sectors whose output prices are fixed at the landed price of import substitutes. If incomes rise as well the demand for non-traded resources will increase putting further pressure on wage rates and hence costs. If the value of exports rises, or if there are large foreign capital inflows to finance the

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'' See Buiter and Purvis (1980), Cordon and Neary (1980), Eastwood and Venables (1980) for examples of models of this sort.

resource expansion, the resulting exchange rate appreciation may put yet additional pressure on the manufacturing sector. Output will certainly fall, as will returns to any specific factors, and unemployment can arise if there is some inflexibility in input prices.

The Dutch disease can be given regional overtones by identifying the booming export sector with the West and the embattled manufacturing one with the East. The energy boom attracts labour and capital from the East to the extent they are mobile, while the higher valued natural gas exports and the voracious demands for capital imports drive the exchange rates up to a point where eastern manufacturing cannot hold its own against foreign competitors. If wages for industry specific labour (e.g., auto workers) are not sufficiently flexible downwards, unemployment results.

Adapting these models for regional purposes in this manner is not very satisfying, however. Most importantly, it misses the intersectoral reallocation within the West which is one of the main concerns of the present study. Western politicians are interested in the implications of the energy boom for industrialization and diversification of the host regional economy. The question arises then as to whether there is an intra-regional counterpart to the Dutch disease, and if so, whether government policies can offset this tendency. In addition, the normal general equilibrium model assumes perfect

mobility of at least some factors intersectorally. If the intersectoral reallocation is also an interregional or spatial one though, this assumption might be more suspect.

A better alternative would be to specify a complete general equilibrium model for each of the regional economies, being careful to account for unique institutional features, and to link them via trade and factor flows. These have only just begun to receive some attention in the regional literature. Flatters (1981) develops a two sector (export and non-traded goods), three factor model in his analysis of the impact of technological change on regional employment. Regional characteristics are introduced via the assumptions that the prices of capital and the export goods are fixed on world markets through perfect mobility. Resource supplies, the factor specific to the export sector, respond to both exogenous discoveries and higher prices. Labour is fixed in supply but unemployment is assumed so there is an ample quantity available at a fixed real wage. The model is solved analytically for the complex of determinants of the regional demand for labour. Technological change lowers unit costs and hence increases the demand for labour via an output effect, as Swan (1978) indicates. But if there is a labour saving bias to the new technology, such that capital is substituted for labour at any given wage-rental rate, Flatters shows that the net effect is uncertain.

Copithorne (1981) presents what he terms an "augmented natural resource staples" model or a "neoclassical synthesis" in his work on the Newfoundland economy. His approch to developing a general equilibrium regional model is instructive in that he does it one sector at a time. He begins with the assumption that everyone is employed in a common property fishery, demonstrates the familiar properties of such a model, and then investigates such policy issues as out-migration, extending the fishery limits to 200 miles, and subsidies to the industry. He then adds a private property natural resource sector to the model, to allow for the accrual of economic rent. A third sector, taken to be an amalgam of import competing and primary processing manufacturing industries, is then added, and then finally a fourth, a non-traded or home goods activity. At each step the process whereby labour is allocated across sectors is analyzed, as is the intersectoral adjustment of this factor to a change in exogenous policy variables.

The feature in the Copithorne model of most interest for present purposes is the specification of the manufacturing sector. In most formulations this particular activity ends up driving the rest of the model.[20] The twin assumptions of constant returns to scale and an exogenous output price imply that the demand curve for labour is perfectly elastic at some fixed wage

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[20] This proved to be the most controversial feature of one of the earliest applications of this model, that by Chambers and Gordon (1966).

rate. In the regional economy case, where factor supplies are often assumed to be highly or perfectly elastic, this means there is no constraint to the expansion of this sector. If wage rates are such that it can produce at all, there is no logical reason why it cannot expand indefinitely. Copithorne avoids this, as Norrie and Percy (1981) did earlier, by postulating a continuum of activities within this sector with a declining regional comparative advantage as one moves down the range. Thus at any given real wage a portion of these processing activities are competitive with foreign supplies. At a lower real wage a number of additional ones will be as well. Copithorne appears to believe that the cost differences are slight, as he draws a highly elastic demand curve for labour for that sector. But the important point is that it does have some downward slope, meaning there is a determinate equilibrium even in the face of highly elastic factor supplies.

Norrie and Percy (1982b) also present a general equilibrium model of a regional economy in their analysis of the impact of proposed freight rate reforms on the West. It has six separate production sectors, specific factors for each sector along with mobile labour, and explicit factor migration equations. There are downward sloping demand curves for the output of all sectors, with those for the five traded ones being justified by an appeal to market area analysis based on using transport costs. As with the Copithorne and Norrie-Percy (1981) analysis above, this

allows a fall in unit costs to expand the sales of the traded goods by a determinate (but admittedly arbitrary[21]) amount. There is also an attempt to differentiate between short and longer run adjustments by allowing the factor supply elasticities to take increasingly larger values as the time frame lengthens.

One obvious problem with all the foregoing models is that they are comparative static in design. They presume that the economy is in an initial equilibrium, and ask what adjustments in endogenous variables would be required to reestablish this condition in the event that it is disturbed by some exogenous shock. This is a useful exercise in cases where the direction of change of some variables cannot be predicted a priori, and it does provide an indication of the magnitude of the ultimate adjustment that can be expected. It does not, however, provide any information on the adjustment process itself, such as how long it takes to work its full effects or how the different sectors fare in the interim. In many instances of policy concern, including almost certainly that under review in this paper, the path of adjustment is as interesting as the structure of the new equilibrium itself. Some form of dynamic optimization model is desirable.

c) Dynamic General Equilibrium Models

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[21] The phenomenon is implemented empirically by specifying arbitrary values for the demand elasticities.

All the models discussed thus far are static in that they treat labour and capital (and land or resources if these are present as an additional input) as primary factors. This is true even of those such as Norrie and Percy (1982b) where variable factor supplies are introduced, since these are postulated to be a function of net returns. A fixed stock of a primary input available to an economy simply becomes a variable stock, in other words. Dynamic models, on the other hand, recognize that capital is a produced output as well as an input, and that there is a determinate relationship among income, savings, investment and the stock of capital. The production of capital goods is a flow, while capital as an input is a stock. Futher, investment is financed out of savings, which depend on income, which in turn depends on the return to capital. If foreign investment or government debt are allowed the problem becomes even more complex as there are additional sets of constraints to be met.

The obvious way to begin to model these dynamic features is to incorporate simple macroeconomic relationships into a general equilibrium framework. Friedlaender and Vandendorpe (1978) do this in their work on the incidence of capital taxation. They utilize the familiar Jones model, but add a government sector, savings, investment, money and bonds. The production equations are the familiar ones, except that tax wedges are explicitly introduced. The labour supply reponds to real wages even intratemporally. Consumers save a portion of their income which

then becomes available for net capital formation. The government purchases output, makes lump sum transfers and redeems maturing bonds out of tax revenues it collects and money and new bonds it issues. It does not employ factors directly, however.

The dynamic features of the model came via the introduction into the model of investment, the possibility of the government financing deficits by issuing bonds or money, and the fact that some of the share values that are associated with their rate of change technique alter in value over time. As the authors state, this dynamic aspect is essential for a proper analysis of the incidence of capital taxes. Changes in taxes, by altering prices, interest rates, incomes and the like, will affect savings behaviour and hence capital formation and output over time. The price they pay for this feature though is that a simple two sector model ends up being exceedingly complex to solve and utilize. They end up adopting a somewhat ad hoc reduced form equation for the change in investment demand rather than deriving it directly from the structural equations, due to non-linearities and data constraints.

Other dynamic, general equilibrium models are now beginning to appear. Two are of special interest to the current project, though we have not had formal access to either at the time of writing. The first is the work by Tim Hazledine (1982) on income effects of the Canadian resource boom for the Economic Council of Canada. The other is Rick Harris' (1982) Ontario Economic Council

study on the implications of Canadian trade liberalization.

The references of the preceeding two sub-sections pertain to the task of modelling a single regional economy, taking the structures of other jurisdictions as given. A true general equilibrium approach, however, would also allow for developments in one region to affect the others, and in turn feed back on the first, and so forth. It would also raise the issues of equity and efficiency in a national as opposed to simply a regional context. The concerns are especially relevant for present purposes since, as already indicated, much of the policy discussion in Canada centers on the interregional implications of the western-based energy boom, and what role the federal government does or should play in it. Thus the final literature reviewed is that pertaining to multi-region models.

d) Multi-Region Models

It is unfortunately the case that multi-regional, interactive models are the least developed area of regional economics. There are two separate issues to be dealt with in an interregional context. The first is to ask how the total national stock of productive inputs, and hence aggregate output, is allocated across regions. In the case of two or more final outputs, this extends to asking how the production of each by region is determined. The second query follows this up by investigating the process of adjustment to any shock to the

initial interregional equilibrium. The analogy to international trade theory is obvious, and indeed it is the case that much of the work follows from this lead. One proceeds by asking, in effect, how standard trade theory results on these two questions need to be modified by the institutional facts that exchange rates are pegged at unity, and factors are legally free to flow across boundaries.

Carlberg (1981) provides a useful example of a strict neoclassical model of interregional economic growth that discusses both the allocation and the adjustment issue. Two regions produce an aggregate output using capital and labour, but with different technologies. Free trade equalizes output prices, and interregional mobility causes factor prices to converge. He investigates how the market allocates factors (and hence national output) to regions, whether the resulting allocation is socially optimal, what the equilibrium or steady state growth rate for the economy is, and what happens if this dynamic equilibrium is disturbed. He shows that the combination of trade and factor flows is sufficient to generate a socially optimal allocation of production, that there is a determinate growth rate common to both regions, ,and that its stability depends on the values of the capital- and labour-output ratios, the savings rates and the rate of growth of the total labour force. Under certain conditions the model can generate the Myrdal back-wash or polarization effect, where all economic activity tends over time

to the most productive region.

An example of a simple, policy-oriented interregional general equilibrium model is the work by Gerking and Mutti (1981) on the shifting of regional production taxes. They have a two region, two good, two factor model. Capital is fixed in supply overall but like final outputs is perfectly mobile interregionally, while labour is perfectly inelastic and specific to each region. Output prices and returns to capital are thus identical across regions while wage rates may differ.[22] The specification follows the familiar Jones trade model, with the additional constraint that the sum of capital in each region is equal to the national endowment. Production taxes on one good in each region create a wedge between output and producer prices. The system is differentiated totally and solved to determine the incidence of these taxes; in particular, the possibilities for exporting them to areas consuming the region's exports.

These two models are useful reference points, but they are much too general and simplistic for present purposes. The regional distribution of national output, once it is at all disaggregated, is better explained by more traditional regional science hypotheses. The adjustment process, if it is to be at all relevant to Canadian policy issues, must be specified to

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[22] The alternative that is sometimes employed is to have technologies differ in the two regions, as in Carlberg (1981). This also avoids problems of indeterminate solutions that would exist otherwise.

incorporate intraregional effects (meaning greater sectoral decomposition and specific factors of production in effect), imperfect mobility of at least some factors of production, an explicit role for government policies, and some attention to the regional balance of payments issue. The first requirement can be met by specifying separate regional economies along the lines discussed for the one region case, and then linking them through explicit trade and factor migration equations to capture the further interdependencies. The second feature is satisfied by drawing on the vast literature linking factor flows to economic variables[23] and the much sparser one attempting the reverse.[24]

Given the nature of the problem to be analyzed, the government policy of most concern is the disposition by regional authorities of the natural resource rent they initially capture. Questions of this sort have occupied the attention of public finance theorists for some time under the guise of the economics of equalization payments in a federal system. Beginning with Buchanan (1952) and Scott (1952) and extending to the present (Economic Council of Canada (1982), Boadway and Flatters (1982)),, concern has been raised that unequal access by local governments to certain types of revenue can have serious implications for national equity and efficiency goals. Basically

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[23] See Greenwood (1975) for a survey of this literature.
[24] This is the "chicken or egg" question in the literature. See Muth (1971) for a basic reference. Wrage (1981) looks at the effects of migration on wage and unemployment disparities in Canada.

the argument is that there are a variety of conceivable circumstances under which one jurisdiction would be able to provide fiscal benefits to its residents at less onerous taxation rates than another, less advantaged one. This would either attract more migrants to the rich region that is socially desirable (fiscally induced migration), or create horizontal inequities among otherwise identical citizens, or both. It is held that a system of equalization payments, whereby funds are transferred in some manner from surplus to deficit jurisdictions, can correct this distortion.

While this literature has generally been classed as public finance, the models typically specify two or more regions linked by trade and factor flows, so they are readily adapted to interregional adjustment issues. Given that it is the energy revenues of the western provinces that are partly at issue, the appeal of extending the traditional general equilibrium model in this manner is understandable. It may be possible to estimate the magnitude of any allocative inefficiencies associated with fiscally induced migration, and to see how sensitive these are to the various parameters involved and how effective alternative types of equalization schemes might be in reducing them.

This literature typically assumes that the regional government disposes of these surplus revenues through the traditional tax-expenditure system. As noted in the introduction, however, there is an increasing tendency among provincial

governments of using these funds to sponsor economic activity directly, either through subsidies or tax concessions to specific types of activities. This province-building, as it is termed, can affect the allocation of resources adversely, both within the region itself and the nation as a whole. Thus in the model to be presented below, the government sector is modelled in such a way that either of these courses of action can be simulated.

The fourth and final requirement that some attention be given to regional balance of payments questions poses the greatest challenge, since little is known in this area. In the static models where all income is consumed the issue does not arise since Walras' Law guarantees that external receipts must equal disbursements. Once savings are introduced however, breaking the identity between income and expenditure, this is no longer guaranteed. It must now be entered as a separate constraint if it is to be a feature of the model. Regions obviously do run deficits or surpluses, often over a very long period of time. But this can only continue indefinitely in the event that the imbalance is automatically accommodated in some manner. If not, regional expenditures will eventually need to move into line with regional output. Thus it is necessary to attempt to incorporate such a process into a multi-region model.

Thirsk (1973), Courchene (1975), Courchene and Melvin (1980), and Norrie and Percy (1981), provide descriptive accounts of such a process based on received balance of payments theory,

supplemented by interregional factor reallocations. An excess of imports over exports (absorption over output in other words) in one region is treated in the manner of a balance of payments adjustment under fixed exchange rates. The decline in income following a fall in net exports reduces the deficit partially but not entirely. If there is any degree of price and wage flexibility in the region, the excess supplies of goods and factors will reduce its costs relatively, increasing exports and reducing imports further. Any remaining deficit which is financed temporarily by an interregional exchange of assets will eventually increase absorption in the surplus region and reduce it in the deficit one to further adjust to the imbalance. Factor flows, to the extent that they take place, will tend to redistribute capital and labour from low to high return areas.

If left alone, some combination of these mechanisms will eventually reequilibrate the economy. The thrust of Courchene's work in this area has been to demonstrate how the various intergovernmental and interregional transfer mechanisms have tended to thwart this adjustment process, creating an increasing cycle of dependence for the recipient regions and turning them into permanent "wards of the state". Norrie and Percy (1981b) and Courchene and Melvin look at the process specifically as it applies to interprovincial energy sales. The relative increases in energy prices has meant a terms of trade shift in favour of the producing provinces. The question then arises as to how a

common currency, customs union such as the Canadian federation is able to effect the interregional real resource transfer involved. Norrie and Percy in particular look at the process from the viewpoint of a regional burden or regional political equity.

This body of literature will be useful for the modelling exercises to follow since it deals directly with the question of adjustment to an exogenous change in the prices of products traded interprovincially. It will need to be extended to accomplish this fully though. Balance of payments adjustments at the national level have been modelled rigorously, but they typically refer to aggregate output. The Courchene-Melvin and Norrie-Percy pieces cast the discussion in terms of specific sectors, but do so only descriptively. They have no formal integration of the income, price, financial and factor flow components, and suggest no way in which government policies can be rigorously modelled.

Final mention in this section should be given to the host of regional econometric models that have appeared recently, surveyed in Klein and Glickman (1977). The most useful Canadian references are Ontario Department of Treasury and Economics (1971) and Mansell and Wright (1981). The main advantage of such models for policy simulation purposes is that they are based on estimated rather than assumed parameter values. The disadvantages are several. Given the lack of much economic data at the regional level, the specification of the equations often becomes ad hoc,

representing a necessary compromise between theoretical rigour and data availability. The models are often recursive rather than simultaneous for example. Most models also treat the region as a small subset of the national economy, with causality flowing one way only.[25] this is clearly inappropriate for this study, since a main object is to assess the impacts of energy developments in the West on the other regions of the country.

In sum then, while there is much in the regional and related literature that is of use for present purposes, there is no single model or approach that is exactly appropriate. The models we develop below represent a combination of characteristics of those surveyed here. The important features we incorporate are the general equilibrium, multi-sector specification, openness with respect to commodity and factor flows, an explicit role for government policies via taxation and expenditure decisions, a role for investment and savings, some attention to regional balance of payments constraints, and explicit interactions between regional economies and national variables.

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[25] Klein and Glickman (1977) distinguish between "top-down" and "bottom-up" approaches to regional modelling.

III A Model of the Western Economy

Six separate sectors for the western economy are identified. There is a trade-off between realism and manageability when it comes to the appropriate degree of disaggregation, but the division chosen here does capture the more important of the intersectoral relationships. The sector production functions can be written as follows:

$$1) \quad X_i = X_i(L_i, K_i, R_i, X^*) \qquad i = 1, \ldots, 6$$

where,

X_i - output of sector i

L_i - labour input to sector i

K_i - sector specific input

R_i - sector and geographically specific land or natural resource input

X^* - vector of quantities of purchased intermediate inputs

The first sector consists of non-renewable primary industries, most importantly oil and natural gas. Sector two represents renewable primary industries such as agriculture and

forestry. Primary output is divided in this manner to allow taxation rates and factor supply elasticities to differ. There is no reason to disaggregate the second sector further here, although it clearly could be done if the model were to be used in a different context. Capital and land (resources) inputs are entered separately. This reflects in part an institutional feature of forestry and oil and gas; the physical capital is largely privately owned while the reserves are predominately crown lands. It is also intended to allow a distinction between a factor such as capital equipment that may be sector specific, and ones like agricultural land or oil pools that are geographically immobile as well.

Both sectors are assumed to produce for the entire local market and have a large surplus available for export. Each activity requires specific inputs such as land or resource deposits that are available in the West, so the region will produce at least some of these products as long as the quality of the resource is sufficient to permit it to compete with the delivered price of alternative supplies. It will export these to the extent that it can land its own products in foreign markets at competitive prices. Total output is limited by the available supplies of inputs of all types, and by downward sloping demand curves in both domestic and export markets. The demand condition in the local market is the standard one. The price sensitivity in export markets stems from a variety of considerations including:

the fact that Canada does possess market power in some instances (wheat, potash); that products are not always homogeneous and thus do not always have readily available substitutes (heavy oil); and that transport costs can create well defined market areas (western coal into Ontario in competition with imports from the U.S.). In each case a fall in western producer prices would lead to a finite increase in the quantity demanded.[24]

Sector number three is resource procesing manufacturing activities. Outputs of sectors one and two will be important purchased inputs here, and costs for this sector will vary inversely with these output prices. Entering a resource processing sector explicitly in this manner is a way of focussing specifically on an activity upon which western industrialization hopes are riding.. There is no geographically specific land or resource input. For those processed products for which the requisite primary input is available, the region is assumed to produce for its own needs as well as a small surplus for export. The extent of the export market will be limited by transport costs in the classical manner, however. There will be a point beyond which the mill price plus transport costs exceed that of a competing supply area, although changes in the mill price will alter the size of the market area and thus export sales. Demand within the region will be price sensitive as well, so the overall demand curve will be downward sloping.

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[24] This is consistent with empirical evidence on the price elasticity of demand for Canadian grain. See Nagy et.al. (1979).

Sector number four produces secondary manufactured products by combining capital and labour with purchased intermediate inputs. It is assumed that the region turns out a portion of this output itself, but is a large net importer overall. This sector cannot be the usual "gadget" industry of the standard neo-classical model, however. To see why, consider the implications of retaining such an artifact. Assume there are constant returns to scale in this sector, identical technologies across regions and internationally, a perfectly elastic supply of the product to the region at a given price, and that foreign and domestic outputs are perfect substitutes. With fixed factor supplies this becomes the residual employer, producing just enough to ensure that all inputs are fully employed. Changes in the output of any other industries will result in an expansion or contraction of this one, with factors (perhaps only labour) moving intersectorally. This is the main feature of the well-known Chambers-Gordon model mentioned previously.

Adapting this model to a small regional economy leads to considerable problems though, since it is no longer possible to consider factor supplies fixed in the longer run. Under the extreme circumstance that the supply of all factors was perfectly elastic, and with a given world price for the product, the region would be able to parlay any miniscule competitive advantage into a massive increase in its market share. Conversely, any slight disadvantage would lead to total contraction of the sector, with

all local consumption being supplied by imports. This all-or-nothing type of behaviour follows necessarily from the assumptions of horizontal long run cost curves, fixed foreign supply prices, and perfect substitutability between domestic and imported goods. Needless to say, as a predicted outcome it is a far cry from reality.

This undesirable feature can be avoided by dropping any one of the three extreme assumptions, or any combination of them. If the foreign supply curve were upward sloping, for example, such that only a portion of it lay below the horizontal long run domestic supply curve, precipitous changes in market shares are precluded. An increase in local costs would cause local producers to lose some of the domestic market to imports, but not entirely since the price of imports would rise as sales expanded until their competitive advantage disappeared. The problem with this option comes in justifying why the supply curve of manufactured products to a small, regional economy should be less than perfectly elastic.

A second alternative is to postulate that foreign products are only imperfectly substitutable for domestic ones. This is, of course, the Armington effect (1969) encountered above. Local output prices now need not be identical to those for imports, though if the elasticities are high they will be closely correlated. A rise in the price of domestic goods relative to those of imported substitutes will induce some substitution of

the latter from the former, but not completely. Similarly, a cost advantage to local producers will allow them to displace only a finite amount of imports. The rationale for invoking the Armington effect is that even technologically identical goods may appear different to consumers once all attributes are considered. Ignorance, brand loyalty, speed of delivery, perceptions about subsequent servicing reliability, and so forth can all play a role in purchasing decisions.

The third option is to make the domestic supply curve upward sloping even in the long run, intersecting the horizontal foreign supply curve from below. This depiction is identical to the familiar tariff analysis of international trade theory, where the share of imports changes as the domestic supply curve shifts. There are three separate justifications for a long run supply curve of this form. First, the production function may exhibit decreasing returns to scale. Alternatively, the supplies of capital and labour to the region may not be perfectly elastic. If they are not, the region will face increasing costs as it attempts to expand output, and costs will fall as sales contract. The same effect will be achieved if manufacturing uses the output of another, non-traded sector such as services as an input, since fluctuations in demand will influence the price of such products.

The final rationale for an upward sloping supply curve for this sector comes from recognizing that what is here termed secondary manufacturing output is in reality a large number of

products of quite different characteristics. Some of these are more firmly established with respect to competition from imports than are others. There are manufactured products for which the West has a strong enough competitive position that it can satisfy the local market and overcome transport costs sufficiently to find sales externally (ATCO trailers). There are others which can be produced for the local market, but which are unable to overcome the transport costs and other barriers to allow them to compete in export markets. Finally, there are products (autos) which are solely imported since local production costs would be far above the landed price of imports.

As western costs rise relatively, it is those products on the margin of competitiveness that are most affected. Some import substitution industries may disappear due to increased competition from imports. In addition, some marginally competitive export industries may find their external sales declining and see themselves relegated to the home market alone. The reverse is true for a fall in regional costs. Some "home" industries will be able to expand into export markets. Other import-competing activities will develop to meet the western demand. Total industrial output will thus expand as a consequence of the fall in costs and prices. Again however, the expansion will not be infinitely large as is implied under the standard formulation. A 10 percent reduction of western costs may encourage some additional furniture production, but it will not

induce auto assembly in the West. The competitive disadvantage with respect to the latter is simply too great.

In earlier work, (Norrie-Percy, 1981b) we adopted the notion of a continuum to illustrate this concept of regional comparative advantage. Like the Ricardian theory on which the Dornbusch, et. al. (1977) continuum is based however, this does not explain why competitive success should differ among goods; it merely asserts that it does. It is our view that there is no one way at present to explain regional comparative advantage in manufacturing. Transport costs and market area analysis from location theory probably explain some of the structure of production, most notably those industries which produce for the home market but do not export. Spin-off technologies from other activities together with aggressive management probably explain some of the export industries (ATCO trailers). Scale economies and an earlier start for established industrial areas likely explain the fact that the West imports all of its consumption of some goods (autos, other consumer durables). Finally, agglomeration economies and inertia undoubtedly explain the long run stability of regional comparative advantages, however initiated.

The models in this paper use combinations of these assumptions. The one region model has both upward sloping domestic supply and downward sloping domestic demand curves. The former follows from the factor migration elasticities employed and the presence of a non-traded sector, while the latter invokes

the Armington effect.

The fifth sector is services or non-tradeables (as distinct from non-traded goods as discussed for sector four), and refers to those activities that must be produced on site. Urban housing is perhaps the best example here, with technical and personal services being another. This sector plays an important role in the model in several respects. It is absolutely very large, it is an important input to other industries as well as a final consumable good, and its relatively greater price volatility provides a key equilibrating mechanism. It is also the centre of some interesting policy issues. It figures prominently, for example, in the debate over whether resource revenue advantages in a region are capitalized into higher prices for services. Owners of land and capital in this sector also correspond to what Richards and Pratt (1977) have termed the urban industrial elite, which in their view is the prime motivating group behind Alberta's economic diversification plans.

The final sector is intended to represent regional government activities. It is assumed that there is some commodity called government goods and services which public authorities provide by hiring labour and combining it with purchased inputs according to some well-defined production function. The output is best described by the term government-provided, impure public goods. Two implications that are important in what follows stem from this description. First, the fact that they are

government-provided means there is no explicit per unit pricing charge for the output, as in sectors one to five; expenditures are covered out of general taxation revenues. Secondly, the fact they are not pure public goods means that as the demand by residents for the services changes, for whatever reason, the government will need to adjust the supply in the same direction. Since this sector competes with the others for available supplies of labour and intermediate inputs there is an opportunity cost to additions to public sector output.

Regional government activites are included as a distinct sector in the model, and specified in this particular way, in order to capture the important policy issues arising from public sector natural resource rents. To illustrate, consider how the composition of final demand is determined within the model. Income is derived by providing labour services and from owning capital and land. A portion of the rental income is appropriated by the regional government through royalties and a corporate profits tax. Residents then save a fraction of their disposable income, in a manner discussed below, and allocate the remainder to consumption. They choose among the categories of goods by maximizing a utility function containing both private and public sector outputs, subject to the constraint that the sum of expenditures, including direct government levies, they face does not exceed income available. Posted market prices exist for private sector products in the usual fashion. The charge for

government services is determined from a requirement that the public accounts balance; any excess of expenditure over revenue available to the government from taxing land and capital is financed by a lump sum or per capita levy on labour. Consumers transform this levy into a price per unit of public sector output, and arrange their purchases such that the standard optimality conditions are met.

It is clear from this description that whenever government revenues from taxing capital and land are positive, the per unit charge to residents for public sector output will be less than the actual expenses incurred in providing it. These products will be relatively inexpensive, and residents will be induced to consume more of them and less private goods than they would in a non-distorted world. There will be an efficiency loss in this instance since the value residents place on the extra units of X_6 will be less than the marginal social cost of providing them. This formulation also allows for fiscally induced migration in that subsidized government services augment the value of any given nominal wage payment. Workers will then move into the region until nominal wages and hence marginal revenue products deviate from their equilibrium interregional values by the amount of this fiscal advantage. Labour will not be efficiently allocated across regions as a result, meaning that total national output will be reduced below its potential value. Given that taxation rates on capital and industry subsidies can be treated

as policy variables as well, the model is clearly able to address the policy issues raised in the introduction.

This specification is chosen since it approximates the process actually in effect in resource rich jurisdictions such as Saskatchewan and Alberta. These governments do derive considerable revenue from natural resource industries, both as landlords and tax collectors, and they typically distribute it through the taxation-government expenditure system via some combination of expanded services and lower taxes. The fact that they continue to do this, in spite of the suspicion that it creates the above-mentioned distortions, and in spite of the fact that superior rent distribution schemes are available, forms the primary motivation for this paper. Specifically, we wish first to explain why a government would rationally choose to follow such a policy, and second to estimate the magnitude of the real income loss involved.

Returning to the production relationships, labour is assumed to be freely transferable among sectors such that a common regional wage rate is maintained. Land or natural resources are obviously sector specific, but the assumption that capital is too requires some elaboration. Normally capital is considered to be specific in the short run only (Mayer, 1974; Mussa, 1974). In the longer run any divergence in returns will be removed via a reallocation among industries. An alternative view, however, is that capital is more mobile internationally within sectors than

it is across sectors, and thus that the internal reallocation might not easily occur even in the longer run (Burgess, 1978). If this latter phenomenon is common internationally, it is surely even more compelling as an assumption for a regional economy such as the Prairies. Capital invested in resource processing, export industries is typically owned outside the region. A decrease in the returns to petrochemicals in Alberta, for example, is more likely to lead eventually to a reallocation of funds to petrochemical processing elsewhere than it is to reinvestment in local agriculture or textile production. The exodus of drilling rigs to the U.S. following the National Energy Program of October, 1980 is another graphic example. Similarly, an increase in the local return to the industry will almost certainly be met by an inflow of "foreign" investment rather than an internal reallocation. For import substitution activities the situation is typically that of a non-resident firm choosing between expanding locally and increasing shipments from plants located externally.

With the sectoral production functions specified, the remainder of this model can be developed. The first equilibrium condition to be met is that unit cost equals price in each of the sectors,

$$2) \quad C^i(w, r_i, s_i, P^*) = P_i \qquad i = 1, \ldots, 6$$

where,

w - the wage rate

r_i - the user cost of capital specific to sector i

s_i - the user cost of land or natural resources specific to sector i

P^* - is a vector of prices of intermediate inputs

P_i - the producer price of output i

In the above formulation, P_6 must be thought of as the cost to the government of providing a unit of the public sector services required. Put differently, P_6X_6 is the amount of revenue that the government will need to raise in some manner to balance its budget. The relationship of P_6 to the charge actually levied on the population to finance the provision of X_6 is discussed below.

The second condition is that the demands for factor services equal the supplies,

3) $a_{Ri}X_i = R_i$ $\quad i = 1, 2, 5$

4) $a_{Ki}X_i = K_i$ $\quad i = 1, \ldots, 5$

5) $\sum_{i=1}^{6} a_{Li}X_i = L$

In these equations a_{mi} is the cost minimizing input of the factor m per unit of output of sector i.

There is no capital goods sector in the model. It is assumed rather that capital services are leased externally as required. Investors will adjust the supply of these services in response to differences in after-tax rental rates among regions,

$$6) \quad K_i = K_i[r_i(1 - t_{Ki}) - \bar{r}_i] \qquad i = 1, \ldots, 5$$

where t_{Ki} is the ad valorem tax on sector specific capital and $\bar{r}_i$ is the after tax rental rate outside the region. Capital is assumed to be highly responsive to movements in rental rates in the long run, but much less so over a shorter period due to lags in arranging for suitable equipment. Supply is a function of nominal rather than real returns since unlike labour, deployment of the factor does not require residency in the region.

The supply of land or resources will depend on the level of after-tax rents, but will likely be relatively inelastic compared to capital.

$$7) \quad R_i = P_i[s_i(1 - t_{Ri})] \qquad i = 1, 2, 5$$

t_{Ri} is the ad valorem tax rate on rental income. Nominal rather than real returns are used for the same reason as in the case of capital. The margin of cultivation for agricultural land can be extended somewhat in response to higher grain prices, and marginal resource deposits will be exploited as expected returns rise. Even the stock of urban land can be expanded through development projects as demand rises. It is assumed for

simplicity that adding to the flow of land services does not use up real resources directly or even indirectly as in the case o capital services. It would be useful to have a construction sector in the model explicitly, but this must await subsequent development.

The supply of labour to the region will be a function of expected real wage differentials between the West and the sending area. It is often asserted that small economies such as western Canada face a perfectly elastic supply curve of labour over the longer run, so that wage rates are given to the region and equal to those in the sending areas less any transfer costs. We assume rather that there is a considerable amount of regional preference involved in internal migration decision. The appearance of small wage gaps between regions may be sufficient inducement for the more mobile members of the labour force, but it will take increasing differentials to move those more reluctant to migrate. This would imply making the labour supply elasticity to the West high but not infinite. Since workers will reside in the region, it is the value of the wage in terms of the price of goods and services that is relevant.

$$8)\quad L = L(w/CPI - \bar{w})$$

where $\bar{w}$ is the real wage rate in the sending region, w is the nominal wage rate in the receiving jurisdiction, and CPI is the regional consumer price index. CPI is calculated as the price of

a basket of private and public goods consumed by a representative individual,

$$9) \quad CPI = \sum_{i=3}^{5} P_i \bar{q}_i + P'_6 \bar{q}_6$$

In the case of sectors three to five the relevant price is the supply price, while for sector six it is the taxation levy on the population per unit of output of X_6, P'_6, defined below.

The next requirement is that the product markets clear. Aggregate demand for regionally produced output is composed of final consumption and intermediate use plus any net exports.

$$10) \quad X_i = Q_i + \sum_j a_{ij} X_j + E_i \qquad i = 1, \ldots, 6$$

Final demand is determined by postulating that a representative consumer maximizes a utility function containing private goods, his perceived share of public sector output, and personal savings (s_p),

$$11) \quad u = u(q_i, s_p) \qquad i = 3, \ldots, 6$$

subject to an income constraint,

$$12) \quad \sum_{i=3}^{5} P_i q_i + t_L + s_p = y_d$$

where y_d is the individual's disposable income, equal to his total factor earnings net of any taxes paid on earnings from capital and land holdings and t_L is per capita levy paid by an individual.

The specification of the demand for X_6 follows that now common in public choice literature (Borcherding and Deacon (1972), Bergstrom and Goodman (1973), Denzan and Mackay (1976), Gramlich and Rubinfeld (1982)). It is assumed for simplicity that each resident perceives himself as obtaining an equal share of total government output,

$$13) \quad q_6 = \frac{X_6}{L}$$

The individual tax burden stemming from public sector activities takes the form of an identical per capita levy set to balance the government budget,

$$14) \quad t_L = [P_6X_6 + H - (\Sigma_i t_{Ri} s_i P_i + \Sigma t_{Ki} r_i K_i)]/L$$

P_6X_6 is total government expenditure, and H is the allocation by the authorities of a portion (h) of non-renewable resource revenue to a Heritage Savings Trust Fund,

$$15) \quad H = ht_{R1}s_1R_1 \qquad 0 \leq h \leq 1$$

This latter feature is intended to represent the Heritage Savings Trust Funds of Alberta and Saskatchewan. These funds have, of course, generated considerable policy discussion,[21] so it is useful to incorporate them explicitly into the model. The bracketed term in the numerator of equation 14) is government revenue from taxing land and capital income respectively.

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[21] See the special issue of Canadian Public Policy of February, 1980 for a discussion of the Alberta Heritage Savings Trust Fund.

If the apparent price of public sector output to the individual resident is defined as,

16) $P_6' = t_L/q_6$

the consumer maximization process yields demand equations of the following form,

17) $q_i = q_i[(y_d - s_p), P] \qquad i = 3, \ldots, 6$

where P is a vector containing output prices P_3 through P_5 and P_6'. These are then aggregated across residents to obtain the equation for Q_i,

18) $Q_i = Q_i[(Y_d - Sp), P] \qquad i = 3, \ldots, 6$

where,

19) $Yd = w.L + \sum_i (1 - t_{Ki}) r_i K_i + \sum_i (1 - t_{Ri}) s_i R_i$

and S_p is aggregate savings.

It can be seen from equations 13) through 16) that $P_6' = P_6$ when $t_{Ri} = t_{Ki} = 0$. That is, in the absence of government revenue from capital and natural resources the levy on residents for an additional unit of public sector output is equal to the marginal social cost to the government of providing it. With these revenues present, however, the consumer price will be below the "true" price by an amount equal to the net (of Heritage Fund allocations) resource revenue available per unit of X_6. This then

is the manner in which the distortions discussed above enter the model. The consumer price index, CPI, defined in equation 9) includes P_6' as indicated. There will be occasion below to refer to $\hat{CPI}$ - the true social cost of a basket of consumer goods, calculated by replacing P_6' with P_6.

There are two ways to model private savings, corresponding to two different concepts of a regional payments balance. In one, savings are given an independent formulation intended to reflect residents' choices between present and future consumption. The simplest example of this would be a text-book Keynesian function linking savings to disposable income,

$$20) \quad S_p = S_p(Y_d)$$

Savings defined in this manner together with public sector savings in the Heritage Fund need not equal the domestic demand for capital services, however, except by chance. Any excess of savings over investment requirements will be matched by an equivalent surplus on merchandise account, and an accumulation by residents of foreign assets. A shortfall, on the other hand, means net imports and foreign investment.

There is clearly no need to require the regional payments accounts to balance in the short run. The very essence of a common currency federation is that financial assets and/or government transfer payments can be reallocated interregionally virtually costlessly. Scitovsky (1969) discusses this process in

general, and Norrie-Percy (1981) apply it to the Canadian setting. Courchene (1978) has argued that in the case of the Maritimes at least, trade deficits can be accommodated for a considerable period of time. In the longer run, however, the interregional adjustment literature suggests there will be a tendency for the accounts to move into balance when not offset by accommodating government transfers. This comes about by some combination of price, income, and factor migration effects. Payments deficits are accompanied by falling prices, incomes, and factor supplies, all of which tend to reduce imports and expand export sales. For a regional surplus the reverse is true. Norrie-Percy (1981) used this last case in fact to illustrate how the increased value of petroleum exports to eastern Canada would eventually be matched by a larger real flow of goods and services to the West.

This long run perspective on the regional balance of payments can be captured by requiring total savings to equal the investment needs of the regional economy.

$$21) \quad Sp + H = \Sigma \bar{r}_i K_i$$

where $\bar{r}_i$ as before is the exogenous external rental rate on capital. With the government sector required to balance its budget, and savings equal to investment, it follows that the value of exports equals that of imports. It must be stressed that in a static model such as the present one, the process of

adjustment in the payments balance cannot be captured directly. It is only possible to compare the outcomes of two comparative statics exercises; one labelled here as a short run where accommodating financial flows are permitted, and a long run one where all accounts are required to balance.

For sectors 3, 5, and 6, Q_i represents the demand for local output since the region is a net exporter of processed resource products, and services and government output are non-tradeable. The demand shown in equation 7) for manufactured goods is for both local and imported products, however. Thus for this sector equation 10) must be rewritten as,

$$22) \quad X_4 = zQ_4 + \Sigma a_{ij}X_j \qquad 0 \leq z,$$

where,

$$23) \quad z = (\bar{P}_4/P_4)^{\sigma_c} \qquad 0 \leq \sigma_c \leq \infty$$

z represents the proportion of the demand for manufactured goods for final consumption purposes that is met from domestic production. If σ_c is set at infinity, local goods and imports are perfect substitutes as in traditional trade models. For values less than this the formulation represents the Armington effect discussed above.[3']

[3']The same effect for manufactured goods used as intermediate inputs is captured by assuming a relatively high value for the technical elasticity of substitution in production between these two classes of products.

The demand for X_i as an intermediate input follows from the definition of the cost minimizing input of a factor per unit of output. The price for sector one's product is exogenous to the model to reflect the institutional fact that oil prices in Canada are set by government decree. Excess demand is assumed to exist at this price, so that output is supply determined. Exports for this product are thus given residually as the difference between total output and its use locally as an intermediate input. The export demand for the output of sectors two and three is a function of their prices relative to foreign ones.

$$24) \quad E_i = E_i(P_i/\overline{P}_i) \qquad i = 2, 3$$

The export demand elasticities will assume a relatively high value in the simulations below, although not infinite for the reasons suggested earlier.

Mention was made in Section II of the common regional science view that agglomeration economies play an important role in the regional growth process. Since these crop up frequently in policy discussions as well, it is of some interest to include them in the analysis. The object in doing this, it should be stressed, is not to attempt to specify agglomeration economies precisely and rigorously, but rather to test the sensitivity of the regional model developed here to this feature.

Because of the theoretical ambiguity surrounding the concept, it is not immediately evident how to enter agglomeration

economies. Do they depend on regional population, for example, or on aggregate output? Do the efficiency gains extend to all sectors, including the resource extractive and processing ones, or are they restricted to typically urban pursuits such as manufacturing and services? Do they extend to government activities as well? Do costs decline indefinitely, or is there some optimal size beyond which diseconomies become apparent?

We have chosen for present purposes to opt for the simplest type of specification suggested by the literature. Agglomeration effects are treated as neutral technical change, related to regional population levels (actually labour force since this is assumed to be a constant fraction of total population), and occurring (identically) in manufacturing, services and government only.

$$25)\quad A = L^{\alpha} \qquad \alpha > 0$$

A will enter the unit cost equations,

$$2)'\quad C^{i}(w, r_i, s_i, P^{*})/A = P_i$$

and the full employment ones,

$$3)'\quad a_{Ri}X_i/A = R_i$$

$$4)'\quad a_{Ki}X_i/A = K_i$$

$$5)'\quad \Sigma a_{Li}X_i/A = L$$

Equation 2)' illustrates that agglomeration economies lower the unit cost for any given production technology and factor prices. The following three equations indicate that the efficiency gains are equivalent to an exogenous increase in factor supplies. If $\alpha = 0$ agglomeration economies are absent, so equations 2)' through 5)' serve as a generalization of 2)-5).

This completes the specification of the model. As it is written there are 45 endogenous variables [w, r_i (5), s_i (3), P_i (5), X_i(6), R_i(3), K_i(5), L, CPI, P'_6, Q_i(4), E_i(3), q_6, t_L, H, Y_d, S_p, z, A] and 45 equations [2'-5', 6-10, 13-16, 18, 19, one of 20 or 21, 22, 23, 24, 25], although this number can be reduced somewhat by appropriate substitution. The value of P_1 (the price of oil) is set exogenously as mentioned above, to represent an important policy variable in Canada. Other exogenous or policy variables include the taxation rates on land and capital, factor returns and commodity prices in other regions, the portion of rent from non-renewable resources allocated to the Heritage Fund, and the rental charge on capital equipment. The system is solved by totally differentiating each of the equations, converting them to a rate of change format (i.e., $\dot{x} = dx/x$), and solving for the endogenous variables as a function of the exogenous ones and the various technical parameters. Since analytical solutions are clearly impossible in a model of this size, the properties are established through a series of simulation exercises. In each the price of oil rises by 1 percent, while the assumption about how

the provincial government uses the resultant resource revenue varies. The rate of change equations together with the data used in the simulations are contained in an Appendix, available upon request.

IV Simulation Results

The basic object of this paper, to repeat, is to analyze the implications of energy developments over the last decade for the western regional economy. This means, perforce, modelling, the West in such a way as to be able to distinguish between changes due to relative price effects and those due to specific rent disposition policies adopted by provincial governments. The specification outlined above was developed to permit just such a distinction. As long as the taxation rates on rental income are positive, the model replicates the Saskatchewan and Alberta practice of using revenues stemming from an energy price increase to provide government goods and services to residents. As was suggested earlier, this separation between the sources of taxation revenue and the eventual beneficiaries can be expected to affect the regional economy more generally. This is accordingly one of the simulations reported in this section.

An alternative, or counterfactual, is to assume that all land, resources and capital are privately owned, and that there are no taxes on incomes from these sources. Government revenues are met instead entirely by a levy imposed on each resident, such

that the price of a unit of public sector output equals the per capita social opportunity cost of providing it. Simulating an energy price rise under these conditions captures the relative price effects alone, since any distortions stemming from subsidizing government output are absent. A comparison of the two sets of results will thus indicate the impact that provincial government rent disposition policies have had on such economic variables as extensive growth (GDP, labour force, investment), intensive growth (per capita real GDP), the distribution of income, the structure of the economy and efficiency gains or losses.

Three separate simulations are provided for each of the two basic scenarios - a short run, a long run where the balance of payments constraint is not binding, and a long run where it is. A third set of results, where agglomeration economies are introduced, is also shown for each of these cases. It is important to note though that while references to short and long runs are meant to imply different real time frames, the model is not explicitly dynamic in the usual sense. It is purely comparative static in that it computes the change in the vector of exogenous variables needed to reequilibrate the system once it has been subjected to an exogenously imposed shock. There is no way to retrieve from the model a path of adjustment from one equilibrium state to the other; it is simply assumed to have occurred.

The notion of time is based on the assumption that factor supply elasticities will differ in the short and long runs. In the initial period following some exogenous shock the supply of land, labour and capital to any region is fixed. Any adjustment takes the form of a reallocation of labour among sectors, and a change in relative factor prices and an alteration in capital- and land-labour ratios as required to ensure full employment. Over a longer time period, however, these changes in rewards are assumed to induce interregional factor flows such that much of any initial differential is erased. Thus the simulations amount to asking what adjustment of endogenous variables is needed to clear the various markets under alternative assumptions about the availability of external factor supplies and which constraints are binding.

Table 1 presents the results of shocking the system by a one percent increase in the price of energy in the classic staple boom case. The terms of trade effect is clearly evident here. Real incomes rise, leading to an increase in demand for the output of sectors 3 through 6. This in turn creates an excess demand for labour and purchased inputs, pushing up their prices and hence production costs for all sectors. The service industries and the government are able to pass along these cost increases in the form of higher prices, so their output expands overall. The four remaining activities lose sales to competing suppliers, however, and contract slightly. Even the energy sector

Glossary
(Tables 1, 2, 3, and 4)

X_1	Output of non-renewable resource sector (oil)
X_2	" " renewable resource sector (agriculture)
X_3	" " primary manufacturing
X_4	" " secondary "
X_5	" " services
X_6	" " government
P_2	Price of renewable output (unit cost)
P_3	" " primary manufacturing output "
P_4	" " secondary " " "
P_5	" " services "
P_6	" " government "
R_1	Land in non-renewable sector
R_2	" " renewable "
R_5	" " service "
K_1	Sector specific capital in non-renewable sector
K_2	" " " " renewable "
K_3	" " " " primary manufacturing
K_4	" " " " secondary "
K_5	" " " " services
L	Labour force
S_1	Rental rate of land in sector 1
S_2	" " " " " " 2
S_5	" " " " " " 5
r_1	rental rate of sector specific capital in sector 1
r_2	2
r_3	3
r_4	4
r_5	5
w	Money wage rate
CPI	Consumer price index (inclusive of P_6')
$\hat{CPI}$	" " " (" of social cost of government output)
P_6'	Tax price paid by consumers of government output
H	Public savings (Heritage type savings funds)
S_P	Aggregate personal savings
INV	Aggregate investment
GDP	Nominal gross domestic product
P	GNE deflator
(W/CPI)	real wages
(GDP/P)	Real GDP
(GDP/P)(1/L)	Real GDP per capita
$(GDP/\hat{CPI})(1/L)$	Real welfare of consumers

TABLE ONE

Provision of Government Goods and Services
Financed Entirely by Personal Taxation

($\dot{P}_1$ = 1.0)

% Change in	SR	LR (no BOP constraint)	LR (BOP constraint)
X_1	-.11	2.45	2.45
X_2	-.35	-.07	-.07
X_3	-.12	.88	.90
X_4	-.15	1.06	1.08
X_5	.04	1.15	1.17
X_6	.38	1.31	1.34
P_2	.12	.18	.18
P_3	.57	.35	.35
P_4	.63	.21	.21
P_5	1.17	.26	.26
P_6	.93	.22	.22
R_1	0.0	2.40	2.40
R_2	0.0	-.03	-.03
R_5	0.0	1.13	1.15
K_1	0.0	2.94	2.94
K_2	0.0	-.04	-.04
K_3	0.0	.90	.92
K_4	0.0	1.09	1.10
K_5	0.0	1.21	1.23
L	0.0	1.04	1.06
S_1	.75	1.20	1.20
S_2	-1.52	-.02	-.02
S_5	2.65	.57	.58
r_1	4.44	.03	.03
r_2	-1.52	-.00	-.00
r_3	-.44	.01	.01
r_4	-.21	.01	.01
r_5	1.50	.01	.01
w	.92	.23	.24
CPI	.81	.22	.23
$\hat{CPI}$	.81	.22	.23
P'_6	.93	.22	.22
H	-	-	-
S_p	1.30	1.54	1.48
INV	0.0	1.47	1.48
GDP	1.30	1.54	1.55
P	1.02	.38	.38
(W/CPI)	.11	.01	.01
(GDP/P)	.29	1.16	1.17
(GDP/P)(1/L)	.29	.12	.11
(GDP/$\hat{CPI}$)(1/L)	.49	.28	.26

experiences this decline as the leftward shift of the supply curve due to cost increases outweighs any movement along it following the output price increase. The shifts in domestic production directly correspond to movements in relative output prices. The only exception is in the case of the government and relative to the service sector. The former expands much more than the latter despite the fact that its relative price rises less. The explanation for this relates to differences in factor intensity. The government sector is much more labour intensive than services and unlike the latter does not use sector specific capital or land. Hence it is able to draw upon the mobile factor, labour, much more in the short run than the services sector. Even in the longer run the expansion of the service sector is constrained relative to government by the use of urban land whose supply curve is upward sloping. All sectors of the economy with the exception of the primary renewable sector expand in terms of gross value of production with the non-traded and energy sectors expanding the most.

The income distributional implications of this further specialization measured in terms of shifts in gross value of production follow directly. Owners of land and capital in sectors one and five experience an increase in nominal returns, although these drop in other instances, most notably for factors specific to other primary industries. The excess demand for labour overall pushes up the nominal wage more than the consumer price index,

meaning that workers receive a slight real wage increase. Nominal GDP rises by 1.30% while the social opportunity cost of providing the basket of consumer goods ($\hat{CPI}$) increases by 0.81%, so real incomes per capita are 0.49% greater. The difference between the rise in real income and that in real output (GDP divided by the GNE deflator) reflects the welfare gain to the region stemming from the terms of trade shift.

In the longer run there is much greater extensive growth in response to the 1% rise in energy prices than what occurred in the short run. GDP increases by 1.45% now, the labour force by 1.04%, and investment by 1.47%. Output of all sectors of the economy save other primary activities increases, with the two non-traded sectors and energy displaying the most rapid growth. Secondary manufacturing output increases by 1.06% which is in sharp contrast to the 0.15% decline of the short run. This growth of industrial output does not reflect increasing diversification of the economy, however, at least if that term is understood to mean a larger relative role for manufacturing. Precisely the reverse happens, in fact. The classic staple orientation of the economy (specialization in staples and non-traded sectors) is reinforced even more strongly now that factor supplies are variable. Growth occurs disproportionately in the energy sector and the two service ones.

The assumption of highly elastic factor supplies in the longer run means there is relatively little change in nominal

returns to capital or in real wages; capital-labour ratios are effectively fixed. Thus any alterations in economic circumstances, such as an exogenously imposed oil price increase, will ultimately be resolved via changes in extensive economic growth. Quantities adjust for such economies over the long run but prices do only slightly. The exception to this is land. The land-labour and land-capital ratio can vary due to the much smaller supply elasticities, meaning that payments to this factor will fluctuate somewhat more. This is most evident in the present case by the fact that landowners in the energy and service sectors continue to receive higher real returns.

Real GDP per capita, evaluated as its social opportunity cost, rises by 0.28% in the long run in comparison to 0.49% in the short run. Economic rents to land are now spread over a larger population base. The volume of government services and their average cost have risen, but there is a larger population base so the per capita tax levy rises by less than in the short run. Savings rise slightly more than investment demand, meaning that income exceeds absorption or equivalently that the region has a small trade surplus. The region is trading real output for financial claims on non-residents, at least to the extent that the central government is not appropriating a portion of these and redistributing them to other regions via some transfer mechanism.

The final column of Table 1 shows the results of requiring the region to balance its trade. As discussed above, this is equivalent to constraining income to equal absorption, which in the present formulation means having the change in savings meet the change in investment demand. Since this condition is very nearly satisfied in the unconstrained case, the changes are slight. The main apparent effect is a slight increase in inmigration, which raises the demand for imports. There is also a slight price effect, due to the expansion of the two non-traded sectors, although not large enough to survive rounding. Both adjustments are consistent with what balance of payments theory predicts would happen in the event of a trade surplus, and they do illustrate the point that regional trade balances not offset by accommodating financial flows will induce real economic adjustments.

With this particular reference or base case specified, the model can now be used to investigate the implications of the regional government adopting specific province-building strategies in an attempt to develop and diversify the economy. The example chosen to illustrate the model is the case where the authorities appropriate a portion of the returns to land and capital, through a system of corporate profits taxes and royalties, and use them to subsidize the provision of government goods and services to residents. This is done mechanically by setting positive values for the taxation parameters on land and

capital, but still requiring the government to balance its budget. The larger the revenues garnered from these sources, the lower the per capita levy required for any given value of government output and population size. Since both expenditures and migration will in turn be affected by any change in the value of the levy, however, the ultimate impact of such taxation measures on regional resource allocation is uncertain.

Table 2 presents the simulation results for this policy option in the same form as Table 1. In the short run the outputs of the first five sectors react much as before, except that the contractions in output are a little larger. Government sector output is 0.40% higher now, compared to 0.38% in the unsubsidized case. Government policies have brought about this altered structure in two ways. First, taxing rental income and channelling a portion of it into the Heritage Fund acts as a withdrawal in a macroeconomic sense since in this unconstrained case there is no requirement that it equal investment. This tends to offset somewhat the increase in demand stemming from the terms of trade change.

The second and much more important factor is that in using the remainder of the taxation receipts as general revenue the government is directly encouraging the consumption of public sector output. Since this sector is a relatively large employer of labour, as it expands it competes for workers with other activities, pushing up nominal wages and hence costs, and causing

TABLE TWO

Provision of Government Goods and Services Financed by Personal Taxation and Taxes on Capital and Resources

($\dot{P}_1 = 0.0$)

% Change in	SR	LR (no BOP constraint)	LR (BOP constraint)
X_1	-.11	2.53	2.47
X_2	-.38	.40	.28
X_3	-.13	1.20	1.37
X_4	-.17	1.55	1.89
X_5	.04	1.54	1.91
X_6	.40	2.47	2.63
P_2	.13	.07	.15
P_3	.62	.23	.31
P_4	.70	.04	.15
P_5	1.29	.11	.24
P_6	1.02	.02	.16
R_1	0.0	2.47	2.42
R_2	0.0	.35	.26
R_5	0.0	1.47	1.84
K_1	0.0	3.02	2.96
K_2	0.0	.40	.30
K_3	0.0	1.19	1.38
K_4	0.0	1.54	1.91
K_5	0.0	1.57	1.97
L	0.0	1.52	1.77
S_1	.74	1.23	1.21
S_2	-1.66	.18	.13
S_5	2.95	.73	.92
r_1	4.36	.03	.03
r_2	-1.66	.00	.00
r_3	-.43	.01	.01
r_4	-.22	.02	.02
r_5	1.66	.02	.02
w	1.01	-.07	.11
CPI	.89	-.08	.09
$\hat{CPI}$	.89	.09	.19
P_6'	1.04	-.86	-.37
H	.74	3.70	3.63
S	1.39	1.78	-.43
INV	0.0	1.77	2.00
GDP	1.39	1.78	2.13
P	1.11	.26	.36
(W/CPI)	.12	.01	.02
(GDP/P)	.29	1.52	1.77
(GDP/P)(1/L)	.29	0.0	0.0
(GDP/$\hat{CPI}$)(1/L)	.50	.17	.17

them to lose sales to competitors. There is a type of crowding out phenomenon, in other words, since with a given supply of primary inputs in the short run the expansion of the government sector must come at the expense of activity elsewhere in the economy. This crowding out due to resource royalties is an oft-cited feature of the Dutch disease, it should be noted.

The income distributional implications follow logically from this altered structure. Landlords and capitalists in the energy sector fare slightly less well than before in a real income sense, due mainly to the higher inflation rate. Their counterparts in the service sector benefit from the policy, however, due to the fact that they were able to pass the cost increases along to consumers. Labour continues to benefit in a real income sense as before, in spite of the higher regional inflation rate, a result of the relative expansion of the labour intensive sectors. Factors that lost in the classic staple boom case continue to do so here to an even greater extent. Aggregate real income, GDP evaluated at the social opportunity cost to the consumers of public sector output, rises by 0.50% here as opposed to 0.49% before. The fact that the per capita charge for government output, P_6', has increased in the short run faster than the social opportunity cost of providing these goods, P_6 , means that some of the distortion in the pattern of demand due to resource subsidies that was in the economy before the current oil price rise has been offset.

These results are instructive when it comes to explaining the political economy of province-building. There are apparent real income gains even in the aggregate. The extensive growth of the economy, as measured by nominal GDP is visibly accelerated. The expanded role for government is certainly consistent with observed trends in a resource rich region such as Alberta. Interestingly, civil servants together with urban service industries such as developers or consulting firms constitute what Richards and Pratt (1978) have termed the urban elite, and which they predict would be most supportive of province-building strategies. The results of this simulation certainly support their contention, as these are precisely the groups that benefit disproportionately in the short run.

The other interesting observation to be drawn from this is the apparent difficulty in promoting manufacturing development in the absence of accommodating factor flows. Provincial spokesmen are long on rhetoric about the key role activities such as these will play in industrial strategies. Yet the logic of comparative advantage and restricted factor supplies makes these goals unrealistic. Norrie and Percy (1981a, 1981b) argued this earlier in connection with empirical evidence on westward shift, and have used it to challenge the western separatist view that an independent West could simultaneously achieve energy prosperity, industrial diversification and a restrictive immigration policy. The logic follows from the neoclassical model utilized, but these

simulations provide striking evidence of the nature of the trade-off involved.

These results hold for the short run, or for a situation where factor supplies are relatively limited. It is instructive to follow this up by looking at the case where factors in other regions are able to respond to the real income opportunities created in the West by the energy price increase. These are presented in column 2 of Table 2 without a balance of payments feedback constraint, and in column 3 with one. The results are most interesting. Looking at column 2 first, all sectors experience an increase in output, with energy and government showing the greatest growth, other primary activities the least, and the other three being intermediate cases. This extensive growth stems from the fact that a large amount of labour and capital is drawn into the region in response to the income gains that were apparent in the short run results. The regional labour force now grows by 1.52%, investment in energy by 3.02% and investment in land and physical capital in services by 0.73% and 1.57% respectively.

What is more surprising perhaps is the fact that there is new investment even in sectors where income fell in the short run. This results because the inflow of labour drives down the capital-labour ratio in these sectors, increasing rental rates enough to make investment attractive. Nominal returns on capital ultimately change very little or not at all, as is required by

the assumption that this factor is in nearly perfectly elastic supply to the region in the longer run. Returns to landowners do rise, especially in the case of energy and services. The increased demands on these sectors outstrip the ability of investors to bring new land or reserves into production, resulting in existing owners capturing intramarginal rents. Workers end up slightly better off in real terms as the rise in nominal wage rates exceeds that for the consumer price index. Generally though the groups that were seen to benefit disproportionately in the short run do so in the longer term as well. The Richards-Pratt observation on the driving force behind the province-building appears to be robust to time periods.

These simulations have captured the fiscally-induced migration phenomenon. Thus a 1% increase in energy prices led to a 1.20% increase in inmigration in the staple boom case, but a 1.52% increase here. This explains the greater extensive economic growth in this second scenario. Fiscal incentives increase the amount of labour available in the region at each money wage. This causes nominal wage rates to fall initially, reducing unit costs to the other sectors and allowing them to expand output. The inmigration at the same time increases the demand for locally produced non-tradeables. On balance this additional demand for labour almost exactly offsets the fiscally-induced supply shift, so that nominal and real wages remain virtually unchanged.

Perhaps the most illustrative result though is the fact that real per capita GNP rises much less in this longer run case as compared to the staple boom; 0.17% as opposed to 0.28%, about two-thirds as much in other words. In part this represents the costs of distorting production towards public sector output, since the apparent cost of such goods to residents is now much less than the true cost of providing them. Additionally, the rapid growth in real GNP is outstripped by an even greater inmigration of labour. The fact that labour can appropriate a portion of the natural resource revenue directly only through consuming subsidized public goods means that the energy price increase leads to a greater inmigration than might otherwise have occurred. From an aggregate perspective, the economic rents are spread over a larger population such that the region as a whole appears worse off by the usual intensive growth measure.

Column 3 gives the results of imposing the balance of payments constraint on the economy. Column 2 shows the same initial improvement in the trade balance as in the staple boom case. The expansion of output in the first three sectors has greatly increased the value of exports of the regions, while the increased activity of the fourth has led to considerable import substitution. Investment needs have risen, but the volume of domestic saving including that in the Heritage Fund has increased much more. Residents are thus earning from production more than what they are spending, meaning they are running a trade surplus

and accumulating assets from the rest of the world. Some combination or income, prices and migration effects will set in to erode this surplus in the event that it is not automatically accommodated.

As can be seen from the column, all three effects come into play. If savings are to exactly cover investment needs only, and if the Heritage Fund is to continue, personal savings actually fall. This increases consumption out of each level of income, including that of imported manufactured goods. In fact, of course, the Heritage Fund continues to hold assets externally, and residents do not view it as a perfect substitute for personal savings as is assumed here. But the simulation does illustrate the point that to the extent the Heritage Fund is even an imperfect substitute for personal thrift, the result will be a greater level of spending including that on imported goods. Fears that Funds such as these may act as fiscal drag on the regional and national economies appear to ignore this fact.

The price effects are shown through the greater regional inflation apparent in the constrained case. The GNE deflator rises by 0.36% as opposed to 0.26%, and the increase in the social cost of the consumption basket more than doubles from 0.09% to 0.19%. Domestic manufactured goods increase in price while imported ones do not, so by the Armington effect the share of the latter rise. Exports of sectors 2 and 3 fall due to higher prices as well. Finally, the larger inmigration, 1.77% instead of

1.52%, further increases the demand for imports. All these together act to bring the region's payments into balance by increasing absorption relative to income. It must be stressed that this is not a prediction of what will actually happen to the regional economy. It is simply a manifestation of the general forces that come into play if regional payments balances are not somehow accommodated in other ways. If residents continue to hold foreign assets, or if the central government appropriates a portion of the financial flow from energy and redistributes it, less of an adjustment is required.

The final two Tables show the results of letting the agglomeration parameter differ from zero for the staple boom and province-building scenarios respectively. Only the long run results are relevant of course, as $\dot{L} = 0$ by assumption in the short run. The first two columns reproduce for convenience the results of the earlier Tables where $\alpha = 0$. Looking at columns 3 and 4 of Table 3 first, the impetus that agglomeration economies can give to both extensive and intensive economic growth is evident. Labour migrates to the region initially in response to real wage gains stemming from the oil boom. There are efficiency gains to sectors 4, 5, and 6 as a consequence of this larger population, allowing them to lower prices and expand output further. This creates additional excess demand in factor markets, leading to more net investment and inmigration. The fact that regional prices are now falling relative to those elsewhere adds

TABLE THREE

Provision of Government Goods and Services Financed Entirely by Personal Taxation and Sectors 4, 5 and 6 Responsive to Agglomeration Economics

($\dot{P}_1 = 0.0$)

% Change in	$\alpha = 0$		$\alpha = .05$	
	LR no BOP Constraint	LR BOP Constraint	LR no BOP Constraint	LR BOP Constraint
X_1	2.45	2.45	2.52	2.52
X_2	-.07	-.07	.37	.38
X_3	.88	.90	1.32	1.34
X_4	1.06	1.08	1.91	1.95
X_5	1.15	1.17	1.79	1.82
X_6	1.31	1.34	1.98	2.02
P_2	.18	.18	.11	.11
P_3	.35	.35	.26	.26
P_4	.21	.21	-.02	-.02
P_5	.26	.26	.07	.07
P_6	.22	.22	-.02	-.02
R_x	2.40	2.40	2.46	2.47
R_2	-.03	-.03	.34	.35
R_5	1.13	1.15	1.64	1.67
K_k	2.94	2.94	3.01	3.01
K_2	-.04	-.04	.39	.40
K_3	.90	.92	1.33	1.35
K_4	1.09	1.10	1.84	1.88
K_5	1.21	1.23	1.76	1.79
L	1.04	1.06	1.59	1.62
S_1	1.20	1.20	1.23	1.23
S_2	-.02	-.02	.17	.18
S_5	.57	.58	.82	.84
r_1	.03	.03	.03	.03
r_2	-.00	-.00	.00	.00
r_3	.01	.01	.01	.01
r_4	.01	.01	.02	.02
r_5	.01	.01	.02	.02
w	.23	.24	.08	.08
CPI	.22	.23	.07	.07
$\hat{CPI}$	.22	.23	.07	.07
P_6'	.22	.22	-.02	-.02
H	-	-	-	-
S_p	1.54	1.48	1.97	1.92
INV	1.47	1.48	1.90	1.92
GDP	1.54	1.55	1.97	1.99
P	.38	.38	.24	.24
(W/CPI)	.01	.01	.01	.01
(GDP/P)	1.16	1.17	1.73	1.75
(GDP/P) (1/L)	.12	.11	.14	.13
(GDP/$\hat{CPI}$) (1/L)	.28	.26	.31	.30

to the migration incentive and thus to the agglomeration effects.

The end result is that all sectors increase output levels beyond those achieved when $\alpha = 0$. Oil production is altered the least; its price cannot vary so the only basis for expansion comes from the shift in the supply curve due to lower nominal wages. Manufacturing is affected the most since it benefits directly from the agglomeration economies as well as from the lower wages, and since the relatively high elasticity of demand for its output allows it to translate these cost decreases into new sales. The two non-traded sectors are able to overcome the constraints on output expansion normally posed by the relatively (i.e., compared to the traded sectors in the model) price inelastic demand for their product. Sectors 2 and 3 are not affected by their agglomeration economies directly, but they are by the fall in money wages and because of the price elastic export demand are able to increase output significantly.

GDP increases by approximately one quarter more in this simulation as compared to the initial one. Inmigration is nearly fifty percent larger, and there are significantly higher levels of net investment in land and capital. Per capita GDP in real terms increases by .02 percentage points compared to the initial position. The cost of the consumption bundle, evaluated at the social opportunity cost of providing the output, falls rather than rises so real per capita income using this measure is .03 percentage points higher than earlier. This reflects the gain to

the economy from the increase in efficiency. Imposing the balance of payments constraint, as is done in column 4, alters the results only marginally. Since relative factor prices and hence factor proportions are effectively fixed by the assumption of highly price responsive external supplies, the need for new investment expands proportionately with aggregate output. Since savings do as well, and since all capital goods are imported, the value of imports rises in step with that for exports.

It must be emphasized again that the model is sensitive to the specification of agglomeration economies. If the value of the agglomeration parameter is increased from .05 to .30, for example (not shown), some startling results emerge. Output in all sectors of the economy except oil declines, and for this sector rises less than in the case where $\alpha=0.0$. Product prices rise rather than fall, there is net disinvestment and labour outmigration. Overall GDP falls in nominal terms and significantly in real terms. Real per capita is unchanged while welfare gains (the availability of the consumption basket evaluated at its social opportunity cost) are much less than they were in the case of zero agglomeration effects.

The explanation for these seemingly perverse results appears to be as follows. Labour initially responds to the terms of trade shift as above, bringing about substantial agglomeration effects. Output prices fall as before and sales begin to expand. Now, however, the region is unable to dispose easily of all the output

it is now capable of producing because of the elasticity assumptions imposed. Prices decline beyond the margin permitted by agglomeration efficiencies, meaning that factor prices must follow suit. This in turn prompts capital and labour to leave for other jurisdictions in search of higher relative real returns. Since the factor migration elasticities are so much greater than any of the others in the model this effect dominates the results. The agglomeration effect ultimately works in reverse, reducing the overall efficiency of the regional economy below what it was in base case with $\alpha = 0$. and thereby erasing some of the real income gain from the terms of trade shift.

The obvious conclusion to be drawn from these results is that the model is apparently quite sensitive to what is assumed about agglomeration effects. This should not be too surprising however. The present specification follows other regional models in assuming highly elastic factor supplies to the region, and relatively high external elasticities of supply or demand for its traded products. Thus any slight change in economic circumstances will induce a large labour response, creating agglomeration economies which further increase the relative economic advantage of the region, leading to additional inmigration, and so forth. A slight competitive advantage can be parlayed into dramatic extensive growth in a world of constant returns to scale, highly responsive factor supplies and price-taking assumptions for product markets. As the usual constraining influence, that

provided by the non-traded sectors, is explicitly removed by the way in which agglomeration economies are entered, the changes are especially dramatic.

Since "real world" regional economies obviously do not exhibit this type of explosive response, one or more of the underlying assumptions must be untenable. Any of a number of changes could be introduced which would have the effect of dampening the response. The value of could be set much smaller, signifying that agglomeration economies are quantitively rather small. Alternatively, it could be specified so as to have a diminishing impact over its range. Decreasing returns in specific production processes could offset the more general efficiency gains. Factors may be much more inelastic in supply even to small regional economies than is commonly supposed. Finally, as the results for large values of α suggest, it may be difficult for the region to capitalize easily on any cost savings if it faces relatively unresponsive demands for its products. Clearly, those who would give agglomeration economies a key role in the regional growth process must also explain why they do not produce the same knife-edge result in practice as they appear to do in theory.

Table 4 presents the results for the same simulations as Table 3, but for the province-building policy option. Since this latter feature was shown above to result in more extensive growth (including inmigration) than the staple boom case, and since the agglomeration economies are tied directly to labour force growth,

TABLE FOUR

Provision of Government Goods and Services Financed by Personal Taxation and Taxes on Capital and Resources and Sectors 4, 5 and 6 Responsive to Agglomeration Economics

($\dot{P}_1 = 1.0$)

% Change in	$\alpha = 0.0$ LR no BOP Constraint	$\alpha = 0.0$ LR BOP Constraint	$\alpha = .05$ LR no BOP Constraint	$\alpha = .05$ LR BOP Constraint
X_1	2.53	2.47	2.61	2.58
X_2	.40	.28	.95	.92
X_3	1.20	1.37	1.78	1.97
X_4	1.55	1.89	2.71	3.10
X_5	1.54	1.91	2.41	2.78
X_6	2.47	2.63	3.26	3.47
P_2	.07	.15	-.01	.04
P_3	.23	.31	.13	.18
P_4	.04	.15	-.24	-.20
P_5	.11	.24	-.13	-.06
P_6	.02	.16	-.28	-.22
R_k	2.47	2.42	2.55	2.52
R_2	.35	.26	.83	.82
R_5	1.47	1.84	2.15	2.51
K_k	3.02	2.96	3.11	3.08
K_2	.40	.30	.95	.93
K_3	1.19	1.38	1.76	1.96
K_4	1.54	1.91	2.56	2.95
K_5	1.57	1.97	2.30	2.69
L	1.52	1.77	2.25	2.52
S_1	1.23	1.21	1.27	1.26
S_2	.18	.13	.41	.41
S_5	.73	.92	1.08	1.26
r_1	.03	.03	.03	.03
r_2	.00	.00	.01	.01
r_3	.01	.01	.02	.02
r_4	.02	.02	.03	.03
r_5	.02	.02	.02	.03
w	-.07	.11	-.23	-.12
CPI	-.08	.09	-.25	-.15
$\hat{CPI}$	.09	.19	-.11	-.06
P_6'	-.86	-.37	-1.02	-.67
H	3.70	3.63	3.82	3.78
S_p	1.78	-.43	2.38	2.70
INV	1.77	2.00	2.33	2.58
GDP	1.78	2.13	2.38	2.70
P	.26	.36	.08	.13
(W/CPI)	.01	.01	.02	.03
(GDP)/P	1.52	1.77	2.30	2.57
(GDP/P)(1/L)	0.0	0.0	.05	.05
(GDP/$\hat{CPI}$)(1/L)	.17	.17	.24	.24

the results of Table 3 should carry through but be even more exaggerated. This turns out to be the case as can be seen directly by comparing columns 3 and 4 of Table 4 with the comparable ones of Table 3. Little wonder then in a political economy sense that provincial governments bent on promoting extensive growth in their jurisdictions, and sold on the notion of agglomeration economies beyond some minimum threshold level, find the province-building policy option such an attractive one. Needless to say, the skeptical comments made above with respect to Table 3 apply here as well.

There are two additional interesting features in Table 4 that warrant mentioning. The first is that with agglomeration economies present, the province-building option can be more attractive in a welfare sense than the staple boom one, contrary to what was found in Tables 1 and 2. For $\alpha = 0$ the changes in real per capita GDP are 0.0% and 0.05% for the distorted and non-distorted cases respectively. As α rises to 0.05 these numbers become 0.05 and 0.14. For certain values of α (eg. $\alpha = .15$) the efficiency gains from agglomeration economies, due in turn to the greater extensive growth promoted, can outweigh the losses due to resource distortions. That is, province-building strategies for certain values of α may yield real welfare gains that exceed those present in the classic staple boom scenario.

V Conclusion

These results give an example of the uses to which the model can be put. There are other obvious candidates for similar simulation exercises, such as corporate tax subsidies in processing industries, privatization of the resource revenues through equal shares to residents, letting the government run a surplus budget as Alberta has done until recently, restrictions on product and factor flows interprovincially, alternative savings rules for the Heritage Fund and so on. There are also a number of problems with a model of this type. Some of these are unique to this particular specification, such as the ad hoc way in which dynamic adjustment is handled. Others stem from the rate of change format, and for this there is no alternative but to move to an alternative solution technique. This is the topic of a subsequent paper.

One can well ask why provincial governments would pursue "province-building" strategies if they only result in per capita income rising less rapidly? There are three possible explanations. First, extensive growth is typically viewed by regional policy makers as a desirable end in itself. Political power of a province within Confederation is clearly tied to its absolute size and much less to how efficiently it uses the stocks of labour, capital and resources within its own jurisdictions. This is not, however, just a phenomenon common to provincial governments. Province-building as a developmental strategy has much the same economic structure and goals as the policy of

"nation building" pursued by federal governments prior to 1930 (Fowke, 1952). Both terms basically refer to policies pursued by policy makers in small open economies to promote the extensive growth of labour and capital within their jurisdictions and to alter the structure of the economy, i.e., diversify production. The costs of province-building (nation building) are simply referred to as the cost of being Westerners (Canadian). Thus if extensive growth is an end in itself, province-building as we have modeled it is remarkably successful. Second, they may well believe that agglomeration economies exist and all that is required for extensive growth is an active government policy to promote regional population growth. We have suggested, however, that there is little proof such agglomeration economies exist and in any case they may have a detrimental impact on the economy.

Third, the answer also probably lies in part in the distributional patterns discussed above. Some groups gain unambiguously as a result of these strategies and none lose absolutely. There is less economic rent per capita available than there would be otherwise under the Alberta and Saskatchewan systems but this redistribution is not made in any event. In other words, this scheme is decidedly inferior to one where the government collected all the economic rents and distributed them to those resident in the region <u>prior</u> to the boom (McMillan and Norrie, 1980). But since residents do not view this as a viable policy option, there are no apparent disadvantages to the present

practice. Pre-boom residents of the energy rich provinces do not benefit to the extent they could from the energy price increase, but this is less of an inducement to move then to political action than if they were actually made worse off by the government's actions. Basically much of the economic rent generated by the energy price increases is dissipated by fiscally induced migration and the relative price distortions within the economy.

Our results differ from those which much of the existing literature (Flatters, et al (1974), Economic Council (1982)) predicts with respect to the impact of fiscally induced migration on nominal wages. The literature suggests that allocating economic rent through the tax base will cause the region abundant in economic rent to become a low money wage area. Migration will ensure that the fiscal advantage of residence in the region will be exactly offset by lower money wages. This result, however, hinges critically on the assumption that the government only provides pure public good i.e., those goods for which increased consumption requires no increase in supply. Once the government is assumed to provide private goods any increase in demand must be met by increasing production. The government sector, however, is labour intensive meaning that upward pressure on money wages results. This rise in nominal wages in most cases leads to crowding out of other sectors of the economy because of rising input costs. We believe our specification of the government

sector is far more realistic than the alternative of having it provide only pure public goods.

We can conclude the paper by returning to the queries posed at the very beginning. To the question of whether the energy boom per se will industrialize and diversify the West, the answer is no. Table 1 demonstrates that increased specialization is predicted, in the short as well as the long run and more so if a balance of payments equilibrating mechanism operates. Table 2, however, shows that rapid extensive growth and some diversification is possible if the provincial government uses resource revenues to reduce personal taxes. A large payments surplus results however, and if this feeds back into the economy it is the non-traded sectors that benefit the most. Simply put, a region cannot sell more of everything to other economies unless it is willing to accept their debt instruments indefinitely.

Table 2 also indicates that a policy of using resource rents in this manner can be costly in an economic efficiency sense, as the real per capita income gains are lower than in the staple boom case. The income distributional implications go a long way towards explaining why a province-building strategy can be pursued politically, even as it reduces real income below that potentially available. Owners of immobile factors such as urban land benefit from the population influx, and as Richards and Pratt have shown this group forms the nucleus of support for the Alberta government. The political economy of province-building is

much like that of providing tariff protection then. The benefits are disproportionately captured by a small group, giving them the incentive to lobby for their implementation and maintenance. The costs, in the form of allocative inefficiencies, are too diffuse to elicit much active opposition. Because of this, much of the economic rent produced by the western energy boom ends up dissipated through resource inefficiencies and excessive inmigration.

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